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Results of the Svjatoj Nos 1991 expedition

Edited by

Jiří Mlíkovský and Petr Stýblo

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Contents

Contents 3-4
Preface 5
Acknowledgments 6-8
List of expedition participants 9-10
ÚESS-SPODEK: background data 11-13

Introduction

Introduction
P. Stýblo 17-21

The Svjatoj Nos wetlands: general description
J. Mlíkovský, M. Chytrý, P. Stýblo 23-30

Birds

Birds of the Svjatoj Nos wetlands, Lake Baikal
D. Heyrovský, J. Mlíkovský, P. Stýblo, T. Koutný 33-75

Comments on the distribution of the Hooded Crane *Grus monacha* in Buryatia
B.O. Jumov 77-78

Population status and food of the White-tailed Fish Eagle *Haliaeetus albicilla* (Aves: Accipitridae) in the Svjatoj Nos wetlands, Lake Baikal
J. Mlíkovský 79-88

Weights and measurements of birds from the Svjatoj Nos wetlands, Lake Baikal
P. Stýblo, J. Mlíkovský 89-102

Other vertebrates

Mammals of the Svjatoj Nos wetlands, Lake Baikal
M. Lípa, A. Reiter 105-117

Reptiles of the Svjatoj Nos wetlands, Lake Baikal
R. Samek, L. Samková 119-126

Amphibians of the Svjatoj Nos wetlands, Lake Baikal
R. Samek, L. Samková 127-135

Comments on the fishes of the Svjatoj Nos wetlands and adjacent bays of Lake Baikal
R. Samek 137-140

Biometry of the swamp minnow *Phoxinus percnurus* (Pisces: Cyprinidae) from the Svjatoj Nos wetlands, Lake Baikal
R. Samek, L. Samková 141-147

Plants

Vascular plants of the Svjatoj Nos isthmus, Lake Baikal
O.A. Anenchonov, M. Chytrý, I. Dobšíček, P. Pešout 151-175

Comments on the genus *Eleocharis* (Cyperaceae) from the Svjatoj Nos isthmus, Lake Baikal
P. Bureš 177-181

Plant communities of the Svjatoj Nos isthmus, Lake Baikal
M. Chytrý, P. Pešout 183-217

Concluding remarks

The Svjatoj Nos wetlands: ecology and conservation
J. Mlíkovský, P. Stýblo 221-236

Index of plant genera 237-240
Index of animal genera 241-242

Preface

The vast area of Siberia, covering some one twelfth of the world, belongs to one of the least known regions of our Planet. The last decades brought an increased interest in ecological and conservational issues around the world, but Siberia remained silent. It was almost closed to foreign biologists, while the results of local scientists, often obtained under very difficult conditions, have been buried in obscure journals, inaccessible proceedings, and in Russian language.

Siberia has a beautiful nature, rich in plant and animal life. Siberia has an endangered and locally devastated nature, inhabited by a number of less known and as yet undescribed species of plants and animals. How many of them are candidates for the World Red Data Book, or candidates of extinction?

Siberian nature needs help and the first step towards it is its detailed description. Members of the expedition, the results of which are presented further in this book, hope that their work will contribute to the aim.

Jiří Mlíkovský
Editor

Petr Stýblo
Petr Stýblo
Editor and
Leader of the Expedition

M. Lípa
Martin Lípa
Chairman of the
ÚESS-SPODEK

Acknowledgments

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- Miss Radka Beránková, ÚESS-SPODEK, Praha.
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- Dr. Kamil Sedláček, Czech Institute for Nature Conservation, Praha.
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- Ing. Jiří Brodina, Agricultural University, Praha.
- Mrs. Alice Řídká, Agricultural University, Praha.
- Mr. Mathew Smith, Praha.
- Mr. Miroslav Stýblo, Praha.
- Mrs. Ludmila Trofimová, Praha.

In the name of the members of the Svjatoj Nos 1991 expedition I thank all of these people and institutions for their unselfish help. At the same time I wish to thank many anonymous other people whom we have encountered during the expedition. Without their help the work of the expedition would be unrealistic.

Mr. V.S. Mel' nikov, director of the Zabajkal' skij National Park, and his vice-directors Mr. Evgenij Ovdin and Mr. Aleksandr Beketov (all Usť-Barguzin), kindly allowed us to work in the Park.

In this monograph, English was improved by Mr. Mathew Smith (Praha); Russian summaries were translated by Mr. Miroslav Stýblo and Mrs. Ludmila Trofimová (Praha).

Petr

Petr Stýblo
Leader of the
Svjatoj Nos 1991 Expedition

List of expedition participants

Foreign participants

Chvátalová, Lenka (1971): Student of the Faculty of Natural Sciences of Charles University in Praha, Czechoslovakia. Botanist; assistant cameraman. In Buryatia on 5-31 July.

Chytrý, Milan (1967): Postgraduate student of the Faculty of Science of Masaryk University in Brno, Czechoslovakia. Responsible for the botanical program. In Buryatia on 25 July - 1 September.

Dobšíček, Ivo (1965): Postgraduate student of the Institute of Tropical and Subtropical Agriculture, Agricultural University in Praha, Czechoslovakia. Responsible for foreign contacts. Botanist. In Buryatia on 27 July - 1 September.

Forget, Frederic (1967): Student of the Faculty of Medicine of the University of Louvaine, Belgium. Chiropterologist. In Buryatia on 30 July - 1 September.

Heyrovský, David (1970): Student of the Faculty of Mathematics and Physics of Charles University in Praha, Czechoslovakia. Responsible for the ornithological program. In Buryatia on 20 June - 31 July.

Kinney, Michael (1963): Lector at the Agricultural University in Praha, Czechoslovakia. Now Mason, Wisconsin, USA. Geologist. In Buryatia on 5-31 July.

Koutný, Tomáš (1972): Student of the Faculty of Biology of Palacký University in Olomouc, Czechoslovakia. Ornithologist. In Buryatia on 25 July - 22 August.

Lípa, Martin (1965): Postgraduate student of the Faculty of Forestry of the Agricultural University in Praha, Czechoslovakia. Responsible for local contacts. Mammaliologist. In Buryatia on 25 July - 10 September.

Mallia, Emanuel (1967): Clerk in Zebbug. Malta. Ornithologist. In Buryatia on 5-31 July.

Mangion, Joseph (1965): Clerk in Zejtun. Malta. Ornithologist. In Buryatia on 5-31 July.

Mlíkovský, Jiří (1954): Research worker in the Department of Evolutionary Biology of the Czechoslovak Academy of Sciences in Praha, Czechoslovakia. Scientific supervisor; responsible for post-expedition publications. Ornithologist, zoologist, ecologist. In Buryatia on 27 July - 1 September.

Novotný, Milan (1966): Student of the Agronomical Faculty of the Agricultural University in Praha, Czechoslovakia. Guide. In Buryatia on 30 July - 25 August.

Pešout, Pavel (1971): Student of the Agronomical Faculty of the Agricultural University in Praha, Czechoslovakia. Botanist. In Buryatia on 20 June - 31 July.

Reiter, Antonín (1970): Student of the Faculty of Natural Sciences of Charles University in Praha, Czechoslovakia. Responsible for the mammaliological program; cameraman. In Buryatia on 5-31 July.

Samek, Radko (1965): Student of the Faculty of Natural Sciences of Charles University in Praha, Czechoslovakia. Responsible for transport. Herpetologist, batrachologist. In Buryatia on 20 June - 31 July.

Samková, Ludmila (1969): Student of the Faculty of Natural Sciences of Charles University in Praha, Czechoslovakia. Vertebrate zoologist. In Buryatia on 27 July - 1 September.

Stýblo, Petr (1966): Student of the Economical Faculty of the Agricultural University in Praha, Czechoslovakia. Leader of the expedition. Ornithologist. In Buryatia on 20 June - 1 September.

Local participants

(a) Scientific co-workers:

Anenchonov, Oleg: Research worker of the Institute of Biology of the Buryat Scientific Center of the Siberian Department of the Russian Academy of Sciences in Ulan-Ude, Buryatia. Botanist.

Bojkov, Timofej: Head of the Department of Botany of the Institute of Biology of the Buryat Scientific Center of the Siberian Department of the Russian Academy of Sciences in Ulan-Ude, Buryatia. Botanist.

Jumov, Bimba: Research worker of the Institute of Biology of the Buryat Scientific Center of the Siberian Department of the Russian Academy of Sciences in Ulan-Ude, Buryatia. Ornithologist.

(b) Organizers:

Arsalanov, Sardak: Clerk in Ulan-Ude, Buryatia.

Baldanov, Sergej: Worker in Ulan-Ude, Buryatia.

Beketov, Aleksandr: Vice-director of the Zabajkal' skij national park in Ust' -Barguzin, Buryatia.

Ovdin, Evgenij: Vice-director of the Zabajkal' skij national park in Ust' -Barguzin, Buryatia.

Rabdanova, Nataša: Lecturer at the Buryat Institute of Technology, Buryatia.

Šagduržapov, Vadim: Employee of the Forestry Industrial Cooperative in Turka, Buryatia.

ÚESS-SPODEK: background data

Institute of Ecological Dreams and Realities - Society for the Limitation of the Deficits of Ecological Capacities.

Address

ÚESS-SPODEK, Kolej BCD, Agricultural University, CS-165 21 Praha 6, Czechoslovakia.

ÚESS-SPODEK is a non-government student organization aimed at training and educating secondary-school and university students in ecology. Since 1989 ÚESS-SPODEK has been working at the University of Agriculture in Praha. Its task is particularly gathering, exchange and spreading of information about nature and environmental protection related to agriculture and forestry, and extracurricular scientific activity for future experts in this field.

Members

The activities within individual programmes are prepared by circa 20-25 students and are accomplished by approximately 200-300 participants from both the ČSFR and abroad. For the time being, our members are students from the Agricultural University (Praha), Charles University (Praha) and Masaryk University (Brno).

Activities

Our activities are being developed in the framework of the programmes, concentrating in the following fields:

1. EXPEDITIONS

- organization of expeditions to the regions with comparatively well-conserved environment, where we gather primary data on the living components of the ecosystems, and the information obtained is then used for endangered species protection purposes.
- cooperation with the Buryat Scientific Center of the Siberian Division of the (former) USSR Academy of Sciences, International Council for Bird Preservation, Fauna and Flora Preservation Society, and the Royal Botanical Gardens in Kew, among others, was established.
- actions undertaken in 1991:
  *Expedition "Svjatoj Nos 1991" 91-day period of research in the Zabaikal' skij National Park used for proposing the management of the area.

*Expedition "México Asombroso" 32-day exploration dedicated to research of rare succulent plant species localities (in cooperation with Universidad Nacional Autónoma de México)

2. BIOLOGICAL AGRICULTURE SYSTEMS (BASs)

- arrangement of student exchanges during summer vacations at biological agriculture farms.
- information exchange within the ČSFR and with foreign countries organizing lectures and excursions.
- activity supporting the idea of domestic and laboratory animal welfare.
- cooperation: Agricultural University in Praha, Academic Club for Animal Welfare.
- activities undertaken in 1991:

*student traineeships in Sweden and Norway

*lecture course on animal welfare

*exhibition for Earth Day

*autumn lectures on biological agriculture and environmental protection problems

*excursion to Austria (1x) and Germany (2x)

3. MELUZÍNA

- summer study camp aimed at the problems of immision-harmed forest (the Krušné Hory mountains)
- actions undertaken in 1991:

*winter seminar of the organizers

*two club programmes

*three week-end voluntary work

*summer camp 23 June - 7 July 1991

4. CHROŠTÍ

- research on the regional system of ecological stability in the Střední Poohří Nature Reserve (being under establishment) carried out for the Agricultural University student theses in cooperation with the Ministry of Environment of the Czech Republic
- actions accomplished in 1991: elaboration of the work methodology and start of field research

In addition to the programmes listed above we cooperate with and participate in the preparation of the Christian Youth and Academic Club for Animal Welfare activities.

Financial coverage

Financial coverage of the expenses is estimated as follows:

- 20% ÚESS-SPODEK members to covering travel, lodging and subsistence costs.
- 50% other sources in ČSFR (Ministry of Education, Youth and Sporting Activities of the Czech Republic, various sponsors, Agricultural University in Praha).
- 30% foreign sources.

Martin Lípa

Martin Lípa
Head of the
ÚESS-SPODEK

INTRODUCTION

Ecology of the Svjatoj Nos wetlands, Lake Baikal.
J. Mlíkovský and P. Stýblo, Eds.
Praha: Ninox Press, 1992.

INTRODUCTION

P. Stýblo
Nádražní 314, CS-262 31 Milín, Czechoslovakia.

History of the Svjatoj Nos 1991 expedition

After returning from a visit to the Baikal region in summer 1989, Petr Stýblo and other students of the Agricultural University in Prague assembled in the newly founded ecological and conservational organization ÚESS-SPODEK and started to evaluate the possibility of organizing an ecological expedition to the area. Thorough search through literature showed how unknown is the nature of eastern Siberia, and during the subsequent visit of Petr Stýblo to Buryatia in summer 1990 a suitable locality was discovered: the Svjatoj Nos wetlands.

Already at first sight, the wetlands were rich in plant and animal life, but the locality was unknown to the world. Moreover, the area was within the newly founded Zabajkal'skij National Park. Discussions with Mr. Aleksandr Beketov, vice-director of the Park, showed, that the Park has no scientific employees to do even a basic ecological description of its area. In addition, an expedition of the Buryat Scientific Center of the Siberian Department of the then USSR Academy of Sciences (now Russian Academy of Sciences) aimed at the botanical and zoological description of the Park, which worked in 1988, focused on the work in the mountains and only passed through the Svjatoj Nos wetlands (Jumov et al. 1989, Tulochonov and Doržiev 1990). Scientists of the Academy continue to work in the Park since 1988, but their number is negligible in comparison to the Park' s area. Mr. Beketov expressed great interest in the cooperation between the Park and the proposed expedition, having been fully aware that appropriate management of the Park is impossible without a thorough knowledge of its nature.

In autumn 1990, after returning from Buryatia, Petr Stýblo and others prepared an expedition project "Svjatoj Nos 1991". The project was submitted to the ICBP/FFPS Expedition Competition Awards for 1991 where it won in the "Wetlands" category. The grant received (3000,- GBP) largely covered the expenses of the expedition and made it financially realistic. However, the situation changed shortly thereafter, when the relations between Czechoslovakia and the then Soviet Union became impaired and Czechoslovak citizens had to pay in the Soviet Union in "western" currency and, worse, at "western" prices. This markedly increased the budget of the expedition (e.g. the prices of flight tickets increased five times). Consequently, the organizers prepared several alternative solutions to the expedition, consisting e.g. in a reduction of the number of participants etc. Fortunately enough, the organizers of the expedition were successful in gathering money and materials from a number of new sponsors, which saved the expedition in its original form.

Aims of the expedition

The primary aim of the expedition was to conduct a thorough description of the avian fauna of the Svjatoj Nos wetlands, with special respects to endangered species, particularly the Hooded Crane *Grus monacha* Temminck, and the Swinhoe' s Yellow Rail *Coturnicops exquisita* (Swinhoe).

We understood, however, that any ornithological information could be interpreted only in the frame of complex data on the whole ecosystem. Because such data were not available for the Svjatoj Nos wetlands, we decided also to gather relevant data on other tetrapod vertebrates and vascular plants. The study of invertebrates and lower plants was left for the future due to the limited budget of the expedition.

Expedition budget

The overall budget of the expedition was 431.000,- CSK (i.e. approximately 8.600,- GBP). Of this money, we obtained 3.000,- GBP and 138.000,- CSK from sponsors in the United Kingdom and Czechoslovakia, respectively (see p. 6), 35.000,- CSK from the ÚESS-SPODEK, and the rest, 108.000,- CSK, was paid by the expedition participants. Overall expenses reached 429.065,- CSK (see the table below). The difference was returned to the ÚESS-SPODEK. In addition, donation and sponsorship of equipment was of great help in many cases.

Preexpedition expenses	
- Administration	16000,- CSK
- Field equipment	16800,- CSK
- Medical equipment	5000,- CSK
- Research equipment	10000,- CSK
- Photographic equipment	51260,- CSK

- Transportation	212225,- CSK
Maintenance expenses	21780,- CSK
Postexpedition expenses	
- Publications	36000,- CSK
- Repairs	10000,- CSK
- Visits of Buryat coworkers in Czechoslovakia	40000.- CSK
- Party for sponsors	10000,- CSK
Total	429065,- CSK

The course of the expedition

The first, preparatory group (Petr Stýblo, David Heyrovský, Pavel Pešout, and Radko Samek) left Prague on 14 June 1991 by train. The group had to bring some 300 kg of scientific and camping material to Buryatia, build the camp, and to organize the start of the expedition. This group arrived in Ulan-Ude, the capitol of Buryatia, on 20 June. Three days later took the trip to Usť-Barguzin, the seat of the administration of Zabajkaľskij National Park. On 24 June, the group had already started to build a camp in the Svjatoj Nos wetlands, approximately 25 km west of Usť-Barguzin.

The second group (Antonín Reiter, Lenka Chvátalová, Michael Kinney, Emmanuel Mallia, and Joseph Mangion) left Prague on 2 July by train. From Moscow, they continued by plane, and arrived in Ulan-Ude on 5 July, and in the base camp on 7 July. On that day, the full program of the expedition started.

The third group (Martin Lípa, Tomáš Koutný, and Milan Chytrý) left Prague on 19 July by train to arrive in Ulan-Ude on 25 July and in the base camp on 26 July. This group worked for five days together with the former two groups to ascertain the proper continuity of the expedition field work.

The fourth group (Ludmila Samková, Jiří Mlíkovský, and Ivo Dobšíček) left Prague on 25 July by train. From Moscow, they continued by plane to arrive in Ulan-Ude on 28 July and in the base camp on 30 July.

Finally, Milan Novotný and Frederic Forget left Prague on 30 July by train. From Moscow on they used plane and arrived in Ulan-Ude on 1 August, and in the base camp on 3 July.

Inbetween, the first expedition participants departed from the base camp. On 30 July, members of the first two groups (except Petr Stýblo) left the camp to return by train to Prague on 4 August. On 22 August, Tomáš Koutný returned to Czechoslovakia by train to arrive there on 25 August. On 25 August, Milan Novotný left Buryatia to travel through Russia and to return to Prague on 3 September, together with the next group. On 31 August, the remaining members (except Martin Lípa) left the camp and returned by plane and train to Prague on 3 September. The last member of the expedition, Martin Lípa, returned to Prague on 12 September 1991.

The Svjatoj Nos 1991 expedition lasted for 91 days, starting officially on 14 June 1991 and having been officially closed on 12 September 1991.

Working conditions

Members of the expedition were housed in the base camp in small tents. The base camp was located in dunes at the edge of marshes. Small groups of members (1-4 people) often left the base camp for 2-4 days to investigate more remote parts of the wetlands. During these short-term trips they were mostly housed in the tents again, exceptionally in an abandoned log-cabin.

Trips in the wetlands were made on foot, or, for longer distances (with heavy baggage), by hitch-hiking lorries. The low frequency of the traffic and absence of quality roads meant that to move for 15 or 20 km took usually a whole day. The drivers of hitch-hiked lorries usually required alcohol and/or cigarettes for the service. It was not possible to hire any cars in Buryatia in 1991.

Local inhabitants were very friendly, but cooperation was not always easy because they do not count time in minutes and hours, as do we Europeans even in the field, but in days. This meant that the timing of any cooperation was almost impossible. We were never attacked by humans or large animals during the expedition. However, several things (instruments and clothing) were stolen from the base camp in mid August, probably by tourists, not by local inhabitants. In addition, a herd of feral cattle almost destroyed the base camp on 19 August, eating everything possible and trampling some tents. There were no problems with bears, although they were present in the area and even in the closest vicinity of the camp. The most troublesome were the myriads of mosquitos and (later in August) of simuliid flies. The area certainly should not be visited by anybody allergic to the bites of these insects.

We survived in the field the communist putsch on 18-21 August 1991. Fortunately enough, its duration was short and we were sufficiently far from civilization to be endangered by it. Admittedly, we lost a couple of hours during those days in doing no science, but developing alternative ways how to safely leave the Soviet Empire.

The weather was rather mild during the expedition, but heavy rains fell sometimes, usually accompanied with strong winds. Field work was almost impossible on such days. A problem was that the weather often changed very rapidly and unpredictably (even for local inhabitants) and that such changes happened rather often. Minimum temperatures recorded were 3°C in July and 5°C in August, respectively. Maximum temperatures recorded in the two months were 32°C and 37°C, respectively.

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Tulochonov A.K., C.Z. Doržiev (Eds., 1990) Priroda Zabajkaľskogo nacionaľnogo parka [Nature of the Zabajkaľskij National Park]. Ulan-Ude: AN SSSR, 193 pp. [In Russian.]

Ecology of the Svjatoj Nos wetlands, Lake Baikal.
J. Mlíkovský and P. Stýblo, Eds.
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THE SVJATOJ NOS WETLANDS: GENERAL DESCRIPTION

J. Mlíkovský[1], M. Chytrý[2] and P. Stýblo[3]
[1]Department of Evolutionary Biology, Czechoslovak Academy of Sciences,
Sekaninova 28, CS-128 00 Praha 2, Czechoslovakia.
[2]Department of Systematic Botany and Geobotany, Faculty of Natural Sciences,
Masaryk University, Kotlářská 2, CS-611 37 Brno, Czechoslovakia.
[3]Nádražní 314, CS-262 31 Milín, Czechoslovakia.

Abstract: A general description of the Svjatoj Nos isthmus is given, with emphasis on climate.

Key-words: Lake Baikal, Svjatoj Nos wetlands, geology, climate, geography.

Introduction

The Svjatoj Nos wetlands are located on the Svjatoj Nos isthmus, north of Usť-Barguzin (53°19' N, 109°01' E) on the eastern shore of the north-central part of Lake Baikal in northern Buryatia. They are bordered from the NW by the rocky Svjatoj Nos peninsula (up to 1877 m a.s.l.), from the W by the Barguzinskij Range, from the SW by the Barguzinskij Bay (72500 ha), and from the N by the Čivyrkujskij Bay (27 000 ha) (Figs. 1-2). The overall surface of the isthmus is approximately 300 km². Sediments of the isthmus are late Quaternary sands originating mainly in the alluvions of the Barguzin river (Imetchenov 1990a), which still brings 0.18 million tons of material each year (Pinegin et al. 1976). The Svjatoj Nos wetlands are at 455 m a.s.l.

Approximately one fifth of the isthmus is covered by Lake Arangatuj (5500 ha). The lake is shallow, mostly less than 2 m deep. Its ground is of brown clays, alternated with patches of sandy bottom. The water is fresh. In summer, when oxygen is in surplus, the reaction of the water is slightly

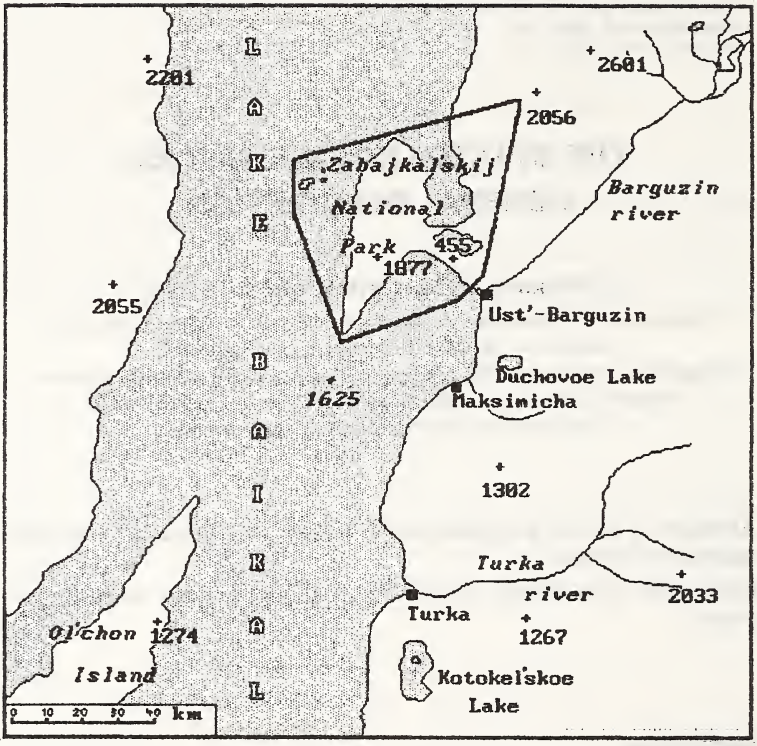

Fig. 1. Location of the Zabajkal' skij National Park at Lake Baikal, Buryatia.

alkaline (Kožov 1962). Two main creeks bring water to the lake: Malyj Čivyrkuj creek collects water in the southernmost part of the Barguzinskij Range, while Burtuj creek brings water from a smaller part of the eastern slopes of the Svjatoj Nos Range. The outflow of the water is into the Istok river in NW part of the lake. Istok river is short and flows into the SW end of the Čivyrkujskij Bay. Lake Arangatuj is covered by ice between late October and early May (Kožov 1962). Maximum temperature of its water (22-25°C) is reached in July (Kožov 1962). At the same time, however, the water temperature is only 14-15°C at the outflow of Malyj Čivyrkuj creek (Kožov 1962).

Formerly, at least two islands were present in the Lake Arangatuj, but they were flooded when the water level of Lake Baikal rose after the Angara dam was completed in 1962 (Moložnikov 1974).

The northern border between Lake Arangatuj and the Čivyrkujskij Bay was formerly made by a sandy bank, up to 2.5 km broad (Kožov 1962), which was flooded in 1962. Now, the transition between Lake Arangatuj and the Čivyrkujskij Bay is less distinct, being formed by a shallow marshy zone.

To the south and southwest of Lake Arangatuj, extensive marshes are present. Among them, more than 100 elongated low sandy coastal mounds occur. They run parallel to the coastal line of Barguzinskij Bay and have been created in consequence of water level oscillations of Lake Baikal during the last centuries (Galazij 1967, 1972). Locally, pine forests are present on these mounds, but the greater part of these forests are dead. They were partly burned and partly withered away after 1962 when the water level of Lake Baikal rose.

A zone several dozen meters wide between the marshes and the shore of the Barguzinskij Bay is formed from sandy dunes of the last coastal mound. They are in part covered by light pine wood patches, particularly in the NW part. More extensive patches of light pine taiga can be found in the southernmost point of the isthmus, near the entrance to the Park.

In the NW part of the isthmus, Precambrian granitoid outcrops form Kovrižka hill, which stands isolated in extensive marshes.

The soils are only slightly developed on young sandy sediments not influenced by the ground water (cf. Kuliš and Pinegin 1976). In large areas with overflowed sandy sediments, the main pedogenic processes are connected with terrestrialization. A peat layer of variable thickness is usually present on the sandy sediments in these mires. Shallow ranker soils are present on granitoids of Kovrižka hill.

In several places, hot mineral springs occur, particularly at Kulinoe in NW corner of the isthmus, and in Zmeinaja Bay on the western shore of the Čivyrkujskij Bay (Tkačuk et al. 1957, Imetchenov 1990b).

Patches of marshes also occur along the shore of the Čivyrkujskij Bay in places where creeks flow into it.

Climate

Generally, the climate of the Lake Baikal region is continental, although huge water masses of Lake Baikal influence the Baikal' s coastal region in the manner of a sea (Žukov 1960, Berbolov et al. 1965, Mizandronceva 1985, Mamaev 1987). Summer temperatures (July) are 4-6°C lower here than elsewhere in the region, while winter temperatures (December) are

5-8°C higher (Bufal and Vizenko 1976, Moložnikov 1976a). The normal year-round fluctuations of air temperatures at Lake Baikal are thus only 30-35°C, while they are 40-50°C farther from Baikal (Bufal and Vizenko 1976). Spring starts 7-10 days later in the coastal region of Lake Baikal than elsewhere in the region (Vychristjuk 1969).

Temperatures undergo marked seasonal fluctuations (Moložnikov 1976b, Filonov 1978). Absolute minimum and maximum recorded was -52°C in January, and +37°C in July, respectively (Bufal and Vizenko 1970). Temperature minima are reached in January/February, maxima in July and August (Imetchenov and Matvejčuk 1990). The first frosts occur during early September to early October, the last ones during the early to middle June (Bufal and Vizenko 1976, Imetchenov and Matvejčuk 1990). The frostfree period lasts for approximately 100 days in Usť-Barguzin (Imetchenov and Matvejčuk 1990). Permafrost was registered 110 cm below ground in the Svjatoj Nos (Moložnikov 1974).

Radiation: The Svjatoj Nos region receives 2200-2400 hours of sunshine yearly; only 30-35 days/year used to be completely without sunshine (Mizandronceva 1985, Imetchenov and Matvejčuk 1990). At the water level, radiation is lower than higher in mountains during the vegetation period, because -- especially in June and July -- fogs are common (Moložnikov 1974). Consequently, lake coasts are generally colder than middle mountain belt and vegetation inversion is present.

Rainfall strongly varies seasonally. Maximum rainfall occurs during summer months (July-August), minimum rainfall during winter months (February-March), but local differences are notable (Vychristjuk 1969, Mizandronceva 1985, Imetchenov and Matvejčuk 1990). The yearly norm lays between 300-500 mm for different localities in the region, which is caused by the position of hill ranges and wind orientations (Vychristjuk 1969, Imetchenov and Matvejčuk 1990). For the Svjatoj Nos isthmus, a precipitation of 350-400 mm/year can be accepted as a standard value (Galazij in Galazij and Lut 1969).

Snow appears for the first time during October and disappears during May. Stable snow lays usually between late October and early May (Moložnikov 1974, Mizandronceva 1985). The depth of the snow layer is generally dependent on altitude in the region (Moložnikov 1974, Poljuškin 1978); in the Svjatoj Nos isthmus the depth of laying snow is only 50-60 cm (Moložnikov 1974).

The relative humidity fluctuates between 55-90% during the year, reaching its maximum during June-August, and its minimum during November-December (Vychristjuk 1969). Local differences may be marked.

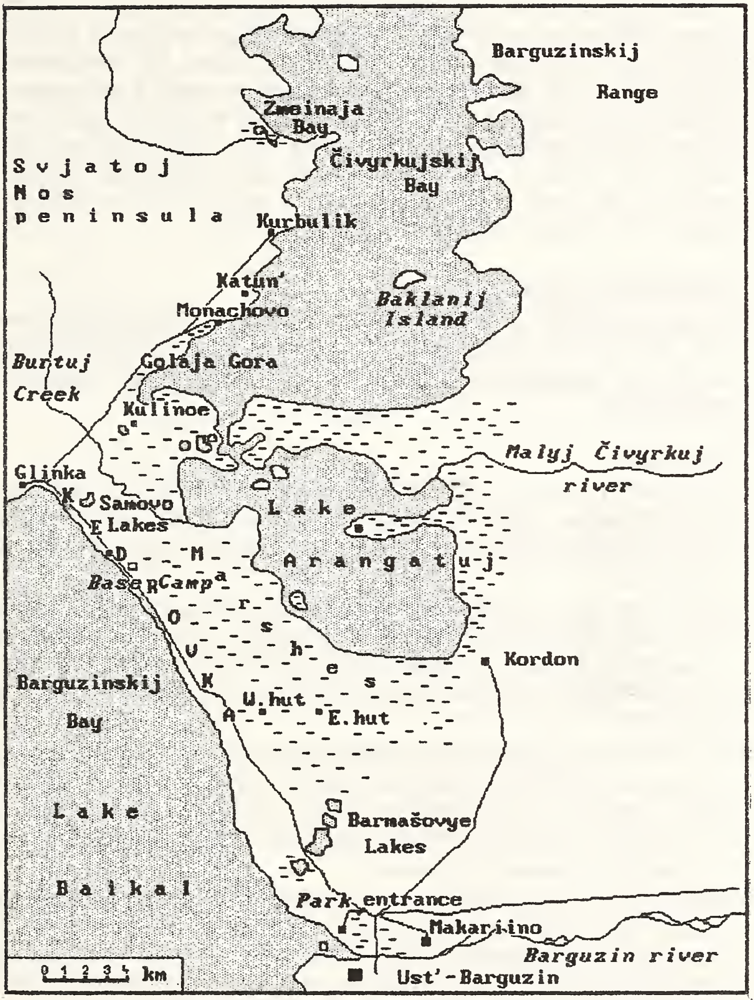

Fig. 2. Map of the Svjatoj Nos isthmus and adjacent parts of the Zabajkal'skij National Park at Lake Baikal, Buryatia.

Winds are common over Lake Baikal. During summer and autumn months, SW winds, so-called kultuks (sg. kultuk), prevail, but W and NW winds occur as well (Moložnikov 1974). During winter, NE winds prevail (Moložnikov 1974). Mean monthly wind speed, measured at the meteorological station at Davša, was 1-2 m/s, but gusts of wind may reach 32 m/s in the region (Imetchenov and Matvejčuk 1990). Also land and lake breezes and mountain and valley winds are very common in the warm period of the year. These two systems of wind circulation often act together and enhance each other (Moložnikov 1976a).

Topographic names

To facilitate reader' s orientation in the topographic names used in this book, we indicated their geographic position in Figs. 1-2. In transverting the Russian alphabet into the Latin one, we used the official system of transliteration.

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BIRDS

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BIRDS OF THE SVJATOJ NOS WETLANDS, LAKE BAIKAL.

D. Heyrovský[1], J. Mlíkovský[2], P. Stýblo[3] and T. Koutný[4]
[1]Na Šťáhlavce 6, CS-160 00 Praha 6, Czechoslovakia.
[2]Department of Evolutionary Biology, Czechoslovak Academy of Sciences, Sekaninova 28, CS-128 00 Praha 2, Czechoslovakia.
[3]Nádražní 314, CS-262 31 Milín, Czechoslovakia.
[4]Čechovice 19, CS-798 21 Bedihošť, Czechoslovakia.

Abstract: Ornithological observations were made on the Svjatoj Nos isthmus and the adjacent parts of Čivyrkujskij Bay between late June and the end of August 1991, with a special respect to wetlands. A list of 177 bird species recorded from the area is first presented here. 145 species were observed during our expedition, of which 40 were new to it. Changes in the composition of the avifauna during the 20th century and the importance of the wetlands for avian conservation are discussed.

Key-words: Lake Baikal, Svjatoj Nos wetlands, Aves, distribution, ecology

Introduction

The knowledge of the avifauna of the Lake Baikal region is generally considered to be relatively good. However, closer investigation of the published reports shows that this applies only to some parts of the area. The best known is certainly the southern end of Lake Baikal, particularly the wider vicinity of Irkutsk (Bogorodskij 1989) and the delta of the Selenga river (Bakutin 1957, Švecov and Švecova 1967, Izmajlov and Borovickaja 1973). Since 1954, ornithologists based at the research station in Davša have been studying birds of the Barguzinskij reserve on the NE shore of the lake (e.g. Filonov 1960, 1961, Gusev 1961, Beljaev 1979, 1980, Anakin 1986, 1990). They paid limited attention to the birds outside the reserve. Ornithological observations in the Vitim hills in NE Buryatia were summarized by Izmajlov (1967) and those in the Chamar-Daban range in SW Buryatia by Vasiľčenko (1987). Special ornithological research was made on the Baikal islands, including Ol'chon island (Litvinov and Gagina 1977) and the Uškan' i islands (Litvinov and Moložnikov 1969, Litvinov and Matvejčuk 1977, Matvejčuk 1982, 1983, 1990). Gagina (1958b, 1961, 1965b) presented a list of the birds of the wider Baikal region (see also Gagina 1967). A list of birds occurring in Buryatia has not been published yet.

Relatively less attention has been given to the birds of the patchy, though extensive Buryat wetlands, with the exception of those in the delta of the Selenga river. Limited research has been made only in the wetlands along the Barguzin river (Gagina 1960, Skrjabin 1960, Ljamkin 1977), along the Muja river (Izmajlov and Chanchasaev 1959), along the Nižnjaja Cipa river (Popov 1987), at Lake Gusinoe (Rožkov and Pšeničnikov 1960), along the Irkut river (Sadkov 1971), along the Verchnjaja Angara river (Gagina 1954, Tolčin et al. 1979), and on the Svjatoj Nos isthmus (see below). Skrjabin (1975) described the distribution and biology of the waterfowl of Lake Baikal.

Acknowledgments: Ornithological observations on the Svjatoj Nos isthmus were made in the frame of the Svjatoj Nos 1991 expedition. We were assisted in the field and we received additional observations from all expedition participants. Local biologists, particularly B.O. Jumov, O.A. Anenchonov, and E.K. Ovdin, provided us with helpful information on the avian life in the Zabajkal'skij National Park. We thank them all.

History of the research

The first ornithological records from the Svjatoj Nos region were made only in the middle of the 19th century, when Gustav Radde visited Ust'-Barguzin in 1855 and observed numerous Great Cormorants and Herring Gulls in Barguzinskij Bay (Radde 1861). No ornithological observations were made in the region for the following half a century.

In 1914 and 1915, a zoological expedition led by G.G. Doppel'mair investigated the Barguzin range, north of the Svjatoj Nos isthmus and made limited ornithological observations near Ust'-Barguzin. Overall, the expedition collected 75 species of birds, which were later identified by Štegman (1936).

The first zoologist, who observed birds directly in the Svjatoj Nos wetlands, was apparently S.S. Turov in 1922 and 1923 (Turov 1923, 1924a,b).

In July 1930, ornithologist B.K. Štegman (1936) briefly visited the Svjatoj Nos peninsula.

Further ornithological research in the Svjatoj Nos wetlands was carried out during the period from the mid 1950s to the early 1960s. The botanist

L.I. Malyšev, who visited the area in 1954 and 1955, also made some ornithological observations (Malyšev 1960). In 1955 and 1957, zoologist O.G. Gusev studied breeding birds on the islands in Čivyrkujskij Bay (Gusev 1960). Two forestry students (A. Čerepanov and A. Černov) collected birds in the area in July 1959 for T.N. Gagina (Gagina 1960). N.G. Skrjabin and K.P. Filonov, then zoologists from the Barguzinskij reserve research station, surveyed the Svjatoj Nos wetlands for birds repeatedly during 1959-1961 (Skrjabin and Filonov 1962). Gagina (1960) published the first list of birds of the Svjatoj Nos isthmus. All these observations were made shortly before the Irkutsk dam raised the water level of Lake Baikal in 1962.

During the last 30 years the ornithological research in the Svjatoj Nos wetlands was very limited. According to Moložnikov (1970), a zoological expedition visited the Svjatoj Nos isthmus in 1967 and 1968. However, the ornithological results have not been published yet. V.G. Egorov studied breeding water birds in 1977-1979 (Egorov 1980), and B.O. Jumov observed birds on the Svjatoj Nos isthmus on several occasions during May to July 1988 (Jumov 1990).

Our ornithological survey of the area, carried out between late June and the end of August 1991, was thus the most complete one ever made in the region and the first one which resulted in a reliably complete list of the birds of the Svjatoj Nos wetlands since the water level of Lake Baikal was raised in 1962 by the Irkutsk dam.

The region

The Svjatoj Nos wetlands are located on the isthmus of the Svjatoj Nos peninsula at the NE shore of Lake Baikal. From their eastern and western sides, the wetlands are shaded by mountain ranges (over 1800 m high), while their northern and southern ends are bordered by Čivyrkujskij and Barguzinskij Bays of Lake Baikal, respectively. Approximately one third of the isthmus is covered by the shallow Lake Arangatuj (formerly also called Rangatuj or Rangotuj). Marshes extend over most of the remaining area. More or less extensive patches of taiga grow along Barguzinskij Bay and in the eastern and western parts of the isthmus. Some of these patches are composed of dead (mostly burned) trees only.

At Čivyrkujskij Bay, mostly forests and scattered cliffs reach the shoreline. Marshes are limited to the shore of the isthmus, mouths of creeks and small coves. The more uniform shore of Barguzinskij Bay is sandy on the side of the isthmus and forested on the side of the Svjatoj Nos peninsula.

During winter (January to April), the area is covered by ice and snow, although small areas of hot springs at Kulinoe may be ice-free. Temperatures range from approximately -35°C in winter to +35°C in summer. The water level is directly influenced by the fluctuations of Lake Baikal. Usually it rises during the period from spring to autumn, but unpredictable fluctuations are possible due to the operation of the Irkutsk dam.

For a more detailed geographic description of the locality see Mlíkovský et al. (1992). The vegetation is described in detail by Chytrý and Pešout (1992).

Both the Svjatoj Nos isthmus and Čivyrkujskij Bay are parts of the Zabajkal'skij National Park, founded in 1986 (Tulochonov and Doržiev 1990).

Observations

Included in this paper are all ornithological observations made by the Svjatoj Nos 1991 expedition in the region of the Svjatoj Nos isthmus and along the western shore of Čivyrkujskij Bay. Fieldwork was carried out by David Heyrovský (DH), Emanuel Mallia (EM), Joseph Mangion (JMa) and Petr Stýblo (PS) between 24 June and 29 July, and by Tomáš Koutný (TK), Jiří Mlíkovský (JM), and Petr Stýblo (PS) from 30 July to 28 August. Additional observations were obtained from Martin Lípa (ML), Pavel Pešout (PP), Antonín Reiter (AR), Radko Samek (RS), and Ludmila Samková (LS).

Direct observations were supplemented by mistnetting. The latter technique was apparently applied for the first time in the region. Weights and measurements of the mistnetted birds are described elsewhere (Stýblo and Mlíkovský 1992).

Standard field guides were used to idetify the birds (Flint et al. 1968, Vinogradova et al. 1976, Ivanov and Štegman 1978, Bruun 1978, Sonobe and Robinson 1982). Additional information was taken from standard lists of birds of the (former) Soviet Union (Stepanjan 1975, 1978, 1990, Ivanov 1976). Breeding records were classified according to the system introduced by the European Ornithological Atlas Committee (Sharrock 1974). The sequence of species and the names used follow Voous (1977).

A comment needs to be made here on the interpretation of the formerly published data on birds of the Svjatoj Nos area. Records were often found to be presented only in general terms, from which it was not clear whether particular observations applied to the area of the Svjatoj Nos isthmus, or not. Hence, such statements as "common in the region of the Zabajkal'skij National Park", or "locally present over all northern Baikal" had to be rejected. Similarly, authors often tended to present their data in a table form, where their own observations were merged with observations by selected earlier authors. There is thus no way to decipher which data was obtained by whom, or what is the author' s original contribution and what is just compilation. In addition, details of observations, such as numbers, circumstances of observations, or exact data, were only rarely given. By these unfortunate practices of presenting records, an unknown proportion of original and valuable data obtained from the Svjatoj Nos area by earlier authors was lost.

Systematic list

Red-throated Diver *Gavia stellata* (Pontoppidan): Common in the marshes. Often seen flying to Barguzinskij Bay. Seen on Lake Arangatuj as well (12 July, DH, EM, JMa). Known as a common breeder in the Svjatoj Nos wetlands already to Turov (1923).

Black-throated Diver *Gavia arctica* (Linnaeus): Common, usually seen flying from the marshes to feed in Barguzinskij Bay. One pair on Lake Kulinoe (27 July, DH; 11 August, PS). A nest with two eggs was found in the marshes SE of the base camp on 28 June (PS). A pair with two half-grown young was observed on 1 August in the marshes near Kedrovka (TK, JM, PS). Known as a common breeder in the Svjatoj Nos wetlands already to Turov (1923) and Gagina (1960).

Great Crested Grebe *Podiceps cristatus* (Linnaeus): One bird was observed in a flock of Common Goldeneyes at Monachovo in Čivyrkujskij Bay (3 July, DH). Common at the southern shore of Lake Arangatuj, where families with young were encountered too (12 July, DH, EM, JMa; 17 August, PS). Breeding of Great Crested Grebes on Lake Arangatuj was confirmed for the first time in 1978 (Egorov 1980). This indicates an increase of the range of the species in the Baikal region. Its breeding area was formerly limited there to SE Baikal and the Bratsk dam (Leonťev 1965, Tolčin 1979, Kuročkin 1982).

Red-necked Grebe *Podiceps grisegena* (Boddaert): Observed in the marshes east of the base camp: 1 adult with 5 juv. (29 July, TK), 1 pair with 1 juv. (2 August, PS) and 1 ad. with 2 juv. (24 August, PS). This species was in the Svjatoj Nos wetlands recorded for the first time by Jumov (1990) in 1988. However, its isolated breeding in northern Buryatia (see Kuročkin 1982) has been known already since the 1960s (Gusev 1965, Škatulova 1979).

Horned Grebe *Podiceps auritus* (Linnaeus): A single bird was observed in the marshes at the Barmašovye Lakes on 21 August (JM). All the Baikal region was included in the breeding range of the Horned Grebe by Kuročkin (1982), but its actual distribution may be very patchy. In northern Buryatia, the species was found breeding on several lakes in the Vitim hills (Škatulova 1979). In the Svjatoj Nos wetlands, Horned Grebes were known to occur during summer (Skrjabin and Filonov 1962), but their breeding has not been confirmed yet.

Great Cormorant *Phalacrocorax carbo* (Linnaeus): Not recorded by us. Great Cormorants used to be common on Lake Baikal, incl. Barguzinskij Bay in the 19th and early 20th centuries (Radde 1861, Turov 1923, Štegman 1936, Vasil'čenko and Prokop' ev 1988). Since then their numbers have sharply decreased. The last large colony in Čivyrkujskij Bay was abandoned in 1954 and the last confirmed breeding record is from 1977 (Egorov 1980). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Bittern *Botaurus stellaris* (Linnaeus): Not recorded by us. Gagina (1958a) listed the Bittern as a breeding species of the Svjatoj Nos wetlands. Skrjabin and Filonov (1962) heard it frequently calling in spring. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Grey Heron *Ardea cinerea* Linnaeus: Common in the marshes. A nesting colony was found in a pine forest just beyond the premises of the park at the edge of the marshes along the Barguzin river. The overall population was estimated at approximately 50 birds, including juveniles (PS). Skrjabin and Filonov (1962) reported that Grey Herons commonly migrate through the Svjatoj Nos wetlands and assumed they could breed there. Common in the marshes according to Turov (1923).

Black Stork *Ciconia nigra* (Linnaeus): Sighted near the Barmašovye Lakes (2 adults on 28 July, TK, EM, JMa), and at the Barguzinskij Bay coast between Kedrovka and Barmašovye Lake (one bird on 30 July, PP). Summer observations in the Svjatoj Nos wetlands were reported by Skrjabin and Filonov (1962). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Whooper Swan *Cygnus cygnus* (Linnaeus): A pair was seen flying in the distance low above the marshes in the southeastern part of the isthmus (26 June, DH). Several times sighted in the wetlands east of Kedrovka (1 ad. on 10 August, TK; 3 ad. on 12 August, FF; 2 ad. on 14 August, TK). Two pairs were observed flying above Lake Arangatuj on 18 August (JM). Five swans were counted in the marshes between the base camp and the eastern hunters' hut and one pair at the hut on 24 August (PS). Whooper Swans were not observed in the Svjatoj Nos area in 1977-1979 (Egorov 1980), although they bred formerly in the Svjatoj Nos wetlands and on the shores of Čivyrkujskij Bay (Turov 1923, Skrjabin and Filonov 1962, Skrjabin 1975). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Swan Goose *Anser cygnoides* (Linnaeus): Not recorded by us. Djagilev and Favorskij (1931) reported on observing geese of this species on Lake

Arangatuj. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Bean Goose *Anser fabalis* (Latham): Not recorded by us. The species is known from the area on spring and autumn migration (Turov 1923, Skrjabin 1961, Skrjabin and Filonov 1962, Skrjabin 1975).

Goose *Anser* sp.: Four unidentified geese flew high above the marshes in the direction from Barguzinskij Bay to the northeast on 28 June (DH).

Ruddy Shelduck *Tadorna ferruginea* (Pallas): A pair was observed near the mouth of the Barguzin river (12 July, DH, EM, JMa). Seen several times at the hot springs near Kulinoe (3 birds on 25 July, EM, JMa; 1 bird on 26 July, DH, EM, JMa; 2 birds on 11 August, PS). Turov (1923) knew this species as a common breeder and autumn migrant in the Svjatoj Nos wetlands. Since then, its status has apparently changed: Štegman (1936) found the species as an uncommon breeder in 1930, and Skrjabin (1975) could not confirm its nesting any more in 1961-1962.

European Wigeon *Anas penelope* Linnaeus: A flock of nine birds was found on a small pool at the edge of the marsh near Barguzinskij Bay (14 July, DH, EM, JMa). Turov (1923) mentioned that this species breeds at Lake Arangatuj, but Štegman (1936), Skrjabin and Filonov (1962) and Skrjabin (1975) have not registered breeding during their observations on the Svjatoj Nos isthmus.

Falcated Teal *Anas falcata* (Georgi): Not recorded by us. Both Turov (1923) and Skrjabin and Filonov (1962) found families of the Falcated Teal at several places of the Svjatoj Nos isthmus (see also Skrjabin 1975). The species was not observed during our expedition, which may indicate that it either became very rare or disappeared from the area. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Gadwall *Anas strepera* Linnaeus: A male and five female-colored birds were found in a flock of Common Goldeneyes in Čivyrkujskij Bay at Monachovo (3 July, DH). The Gadwall was a common breeder on Lake Arangatuj in the early 1920s (Turov 1923), but Skrjabin (1975) managed to find only one family with five ducklings during his observations in the area in 1961.

Baikal Teal *Anas formosa* Georgi: Not recorded by us. A regular spring and autumn migrant in the Svjatoj Nos wetlands, with numbers largely varying from year to year (Skrjabin 1975). There are only three summer records from the area (all on Lake Arangatuj): a single bird on 6 August 1922 (Turov 1923), a single bird on 27 July 1961 and a pair on 28 July 1961 (Skrjabin 1975).

Teal *Anas crecca* Linnaeus: Common, usually seen in small flocks of up to six birds in the marshes. Larger flocks were observed in August (30 birds near Kedrovka on 12 August, TK). A common breeder according to Skrjabin (1975).

Mallard *Anas platyrhynchos* Linnaeus: Common. Mostly single birds were observed in the marshes in July. The most commonly observed duck in August (a flock of 20 birds near Kedrovka on 12 August, TK). Found also at Čivyrkujskij Bay in Zmeinaja Bay and on Lake Utinoe (DH, EM, JMa). Also Turov (1923), Skrjabin and Filonov (1962) and Skrjabin (1975) knew the Mallard as a common breeder of the Svjatoj Nos wetlands.

Black Duck *Anas poecilorhyncha* Forster: Not recorded by us. This duck has spread to the north since the 1950s (Skrjabin 1965, 1975). Its breeding on Lake Arangatuj was confirmed for the first time in 1961 (Skrjabin and Filonov 1962). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Pintail *Anas acuta* Linnaeus: The most common duck in the marshes in July, often seen in small flocks (up to six birds). A female with five ducklings was observed at the edge of the marsh near Barguzinskij Bay on 14 July (DH, EM, JMa). Observed only once in August near Kedrovka (2 birds on 14 August, TK). Common breeder according to Skrjabin and Filonov (1962) and Skrjabin (1975).

Garganey *Anas querquedula* Linnaeus: Uncommon, single birds seen in the marshes. Considered to be an uncommon breeding bird by Turov (1923) and Skrjabin (1975).

Northern Shoveler *Anas clypeata* Linnaeus: Uncommon, usually seen in pairs in the marshes. A female with 5-6 still flightless young was observed at the Barmašovye Lakes on 30 July (JM). According to Skrjabin (1975), the Northern Shoveler was a common breeding bird of the Svjatoj Nos wetlands during his observations. The species was not recorded in the region in the 1920s (Turov 1923, Štegman 1936).

Pochard *Aythya ferina* (Linnaeus): Very common on Lake Arangatuj, where families with ducklings were found. Uncommon in the marshes, seen at the Barguzin river. This confirms earlier observations by Štegman (1936), Skrjabin and Filonov (1962) and Skrjabin (1975).

Tufted Duck *Aythya fuligula* (Linnaeus): Uncommon, single birds and pairs were seen in the marshes. More common at Lake Arangatuj. Considered a common breeder 30 years ago (Gusev 1960, Skrjabin and Filonov 1962, Skrjabin 1975).

Harlequin Duck *Histrionicus histrionicus* (Linnaeus): Not recorded by us. Two birds were observed on Lake Arangatuj on 24 May 1962 by Skrjabin (1975). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Velvet Scoter *Melanitta fusca* (Linnaeus): Large flocks seen flying high above Barguzinskij Bay and the marshes (120 birds on 30 June, 44 on 1 July, 63 on 14 July, 25 on 28 July; DH, EM, JMa, PS). Three birds seen flying above Lake Arangatuj (9 July, DH, EM, JMa), 10 birds feeding in Barguzinskij Bay (20 July, DH, EM, JMa, PS). Not observed in August. Reported from the wetlands in 1930 as a common breeder by Štegman (1930). Also observed in 1988 by Jumov (1990). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Common Goldeneye *Bucephala clangula* (Linnaeus): Abundant on Lake Arangatuj, common at Čivyrkujskij Bay (an exceptional flock of 120 birds at Monachovo on 3 July, DH). Two families with young were found - at Monachovo (2 July, DH - 5 ducklings) and in Zmeinaja Bay (23 July, DH, EM, JMa - 4 ducklings). Known to Skrjabin (1975) both from Lake Arangatuj and Čivyrkujskij Bay.

Smew *Mergus albellus* Linnaeus: On 25 June a nesting hole with five ducklings was found in the split of a pine tree growing in the dunes near the base camp (DH). A female was flushed from the nest. On the next visit (27 June) the nest was empty. Later in the end of June a female was seen several times flying from the marsh along a canal near the camp into the forest. A single female was sighted in the marshes near Kedrovka on 29 July (TK), a female with 4 still flightless young was observed there on 1 August (TK, JM, PS). Another female with two young was seen in the marshes near the western hunters' hut on 25 August (PS). Smews reach the southern limit of their breeding range at the northern part of Lake Baikal. The first breeding record in the region was made in 1960 near Kurumkan in the Barguzin valley (Gusev 1965). In the same year, Skrjabin (1975) shot a young flightless Smew at Lake Arangatuj. Egorov (1980) already mentioned the species as a breeder at Lake Arangatuj.

Red-breasted Merganser *Mergus serrator* Linnaeus: Flocks of as many as forty birds were observed in Barguzinskij Bay, several birds along the coast of Čivyrkujskij Bay. Formerly known as a rarely breeding, but commonly migrating species (Skrjabin and Filonov 1962, Skrjabin 1975, Egorov 1980).

Goosander *Mergus merganser* Linnaeus: Not recorded by us. Gusev (1960) found a nest of this species on Baklanij island in Čivyrkujskij Bay. Known to Skrjabin (1975) as a summer visitor and a common migrant.

Black Kite *Milvus migrans* (Boddaert): Common throughout the studied area (see also Turov 1923, Štegman 1936, Malyšev 1960).

Pallas' s Fish Eagle *Haliaeetus leucoryphus* (Pallas): Two adult birds were seen flying above the marshes near Kedrovka on 24 August (JM). Previous recent records of this species in Buryatia were limited to the basins of the Oka and Tugluj rivers in southern Buryatia (Doržiev 1987, 1988) and to the Svjatoj Nos isthmus, where two individuals were observed on 5 May 1988 at Lake Kulinoe (Jumov 1990). Unknown to, or rejected by Doržiev (1988) were observations by Turov (1923) who considered these eagles common breeders (!) between Usť-Barguzin and Sosnovka. Štegman (1936) observed two adult birds on Oľchon island in mid July 1930. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

White-tailed Fish Eagle *Haliaeetus albicilla* (Linnaeus): Both adult and immature birds were regularly seen at the marshes, usually perching on dry trees. Also observed at Kulinoe, the Barguzin river and Čivyrkujskij Bay (at Lake Krestovskoe and between Kresty and Kurbulik). Six nests were found in trees near the marshes (for description see Mlíkovský 1992). Three fully fledged young birds were found in one of the nests in a pine forest near the base camp (14 July, DH). Food remains were collected from under the nests. See Mlíkovský (1992) for the results of their analysis. White-tailed Fish Eagles were formerly relatively common in the NE of the Lake Baikal region (Štegman 1936, Skrjabin and Filonov 1962), but later started to decline in the entire Buryatia (Gusev 1976). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Marsh Harrier *Circus aeruginosus* (Linnaeus): Common in the marshes. Both males and females were found to have an atypical white rump.

Hen Harrier *Circus cyaneus* (Linnaeus): A single adult male was observed flying over marshes at Kedrovka on 17 August (JM). According to Skrjabin and Filonov (1962), Hen Harriers were common autumn migrants in the region of NE Lake Baikal; their breeding in the region was only assumed. Štegman (1936) encountered the species in the marshes in July 1930, Jumov (1990) in summer 1988.

[Pied Harrier *Circus melanoleucus* (Pennant): Jumov (1990) reported on observing this species in summer 1988 in the Svjatoj Nos wetlands. Later (B.O. Jumov, pers. communication, August 1991) he reconsidered the observation, concluding that he in fact observed aberrantly colored Marsh Harriers *Circus aeruginosus*.]

Northern Goshawk *Accipiter gentilis* (Linnaeus): Single birds were regularly seen flying at the edge of the marsh at Kedrovka, at Lake Arangatuj and at Kulinoe.

Sparrowhawk *Accipiter nisus* (Linnaeus): Not recorded by us. Reported by Jumov (1990) as an uncommon bird in the wetlands in summer 1988.

Buzzard *Buteo buteo* (Linnaeus): Observed only twice: in the dead forest at Kedrovka (4 July, DH) and near the Barmašovye Lakes (28 July, DH).

Spotted Eagle *Aquila clanga* (Pallas): Single immature and adult birds were regularly seen in the marshes and in the surrounding trees. Observed near Kedrovka, near Kulinoe, at the southern shore of Lake Arangatuj (two birds on 12 July, DH, EM, JMa) and near the Barmašovye Lakes (two birds on 28 July, TK, EM, JMa). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Golden Eagle *Aquila chrysaetos* (Linnaeus): An immature bird was observed in the dead taiga at Kedrovka on 6 August (JM) and an adult bird at Kulinoe on 12 August (JM, PS). The species was formerly reported from the Svjatoj Nos wetlands by Štegman (1936), who observed it there in July 1930. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Osprey *Pandion haliaetus* (Linnaeus): Regularly seen near Kordon at Lake Arangatuj and at Kulinoe. Single birds were observed flying above the marshes from Barguzinskij Bay to the northeast on 28 June (DH), at Glinka on 2 August (2 birds, TK), at Golaja Gora on 5 August (TK, JM, PS) and at Samovo Lake on 7 August (LS). A nest was known to the local hunters in the taiga near Kordon. Known from the Svjatoj Nos wetlands already to Turov (1923) and Štegman (1936). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Kestrel *Falco tinnunculus* Linnaeus: Single birds were observed near the Barmašovye Lakes (28 July, EM, JMa), at Golaja Gora (4 August, JM) and at Kedrovka (7 August, JM; 23 August, PS).

Red-footed Falcon *Falco vespertinus* Linnaeus: Not recorded by us. Common in the Svjatoj Nos wetlands in summer 1988 according to Jumov (1990).

Hobby *Falco subbuteo* Linnaeus: Regularly observed at forests and the edges of marshes near Kedrovka, near Kordon and at Kulinoe. A Hobby unsuccessfully attacking a Black-headed Gull was observed near Kordon on 16 July (DH). A likewise unsuccessful attack on Little Stints was observed at the Barmašovye Lakes on 21 August (JM). Formerly, Hobbies were commonly observed in summer in various parts of the Svjatoj Nos isthmus (Štegman 1936, Malyšev 1960, Skrjabin and Filonov 1962), but breeding has not been confirmed yet. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Saker *Falco cherrug* Gray: Single birds were observed on 31 July at Kedrovka (TK, JM, PS) and on 6 August in the marshes east of Kedrovka (LS). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Peregrine Falcon *Falco peregrinus* Linnaeus: Not recorded by us. Skrjabin and Filonov (1962) observed a Peregrine Falcon on the Svjatoj

Nos isthmus on 23 July (year not given). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Hazel Grouse *Bonasa bonasia* (Linnaeus): Single birds were observed in taiga with rich undergrowth: south of Monachovo, south of Kordon (a female with at least four chicks on 11 July, DH, EM, JMa; 20 August, TK), north of Kurbulik and at Kulinoe (DH, EM, JMa). A flock of 7 individuals was observed in the marshy taiga near Kordon on 22 August (ML).

Willow Grouse *Lagopus lagopus* (Linnaeus): Not recorded by us. The species breeds in the mountain tundra of the Svjatoj Nos peninsula and descends in winter to the isthmus (Skrjabin and Filonov 1962). It is notable that the Ptarmigan *Lagopus mutus* (Montin) which breeds in the same area winters on its breeding places and does not descend to lower altitudes (Skrjabin and Filonov 1962).

Black Grouse *Tetrao tetrix* Linnaeus: Not recorded by us. Formerly bred on Baklanij island in Čivyrkujskij Bay and 10-12 males used to display on Kovrižka hill (Gusev 1960).

Common Quail *Coturnix coturnix* (Linnaeus): Not recorded by us. Jumov (1990) reported that Common Quails occur in the Svjatoj Nos wetlands in small numbers, though more commonly than Japanese Quails.

Japanese Quail *Coturnix japonica* Temminck & Schlegel: Not recorded by us. The species was found breeding on the Svjatoj Nos isthmus by Malyšev (1960) and Skrjabin and Filonov (1962). Jumov (1990) considered it a rare species of the wetlands. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Baillon' s Crake *Porzana pusilla* (Pallas): A juvenile bird was mistnetted in the marshes at Kedrovka on 25 August (JM). A common breeder of the Svjatoj Nos wetlands according to Skrjabin and Filonov (1962). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Crake *Porzana* sp.: A strange crake was observed in the interior of the marshes near Kedrovka on 1 August (TK, JM, PS). It was the size of a European Starling or slightly larger, its head, breast, flanks, wings and back were uniformly bronze-brownish, without any markings. The bill was short. The bird ran out of sedges and stayed for several seconds on a floating moss islet. Thereafter it quickly returned back to the sedge cover. We were not able to identify this bird.

[Swinhoe' s Yellow Rail *Coturnicops exquisita* (Swinhoe): Recorded neither by us, nor by any previous observer. We paid special attention to the possible occurrence of this species in the Svjatoj Nos wetlands. We also tried to attract the bird by replaying the voice of its sister species *Coturnicops noveboracensis* (Gmelin). However, no signs of the occurrence of the Swinhoe' s Yellow Rail in the region were obtained. There are only seven records of this species from the whole of USSR so far, including two in the wider vicinity of Lake Baikal, both in the Čita Province (Kuročkin and Košelev 1987). The first of these records was reported by Dybowski and Parrex (1868) from the region of Kurort-Darasun in 1867, who collected there a female and found a nest with eggs. The second one was by Gagina (1965a,b), who collected a young female and observed several other individuals at the river Karenga near the village of Tungo-Kočen in the Čita province.]

European Coot *Fulica atra* Linnaeus: Not recorded by us. Egorov (1980) was told by local inhabitants that Coots formerly were common breeders in the area of the river Istok, but were exterminated shortly after 1957 when local hunters and poachers started to use motorboats. Skrjabin and Filonov (1962) remarked that Coots were abundant in the Svjatoj Nos wetlands during migration, but have not mentioned the years for which this observation applied. Jumov (1990) reported that coots were rare in the Svjatoj Nos wetlands in 1988, but gave no details.

Common Crane *Grus grus* (Linnaeus): Heard very often. Both adults and young were seen in the marshes of the isthmus from Kulinoe to Kordon and on wet meadows with scattered bushes and trees in the western part of the isthmus. Our observations confirm that this species is still common in the Svjatoj Nos wetlands (Turov 1923, Skrjabin and Filonov 1962).

Hooded Crane *Grus monacha* Temminck: A strange voice of probably two cranes, possibly of this species, was heard and recorded in the early night on 23 August from the marshes near Kedrovka (JM, PS). An employee of the Park told us he saw two cranes of this species in early June in a small bay at the northwestern coast of Čivyrkujskij Bay. Local villagers told us they observed Hooded Cranes (which they new quite well) in the marshes near the Barmašovye Lakes in the early morning approximately on 16-17 August. This species is listed in the Red Data Book of Buryatia (Pronin 1988). Current knowledge of the distribution of this species in Buryatia was summarized by Vasil'čenko and Prokop' ev (1988b) and Jumov (1992).

Great Bustard *Otis tarda* Linnaeus: Not recorded by us. Skrjabin and Filonov (1962) reported that local hunters knew the species as a rare, but regular vagrant to the Svjatoj Nos isthmus. The Great Bustard, which is generally rare in Buryatia (Kel'berg and Smirnov 1980, Šargaev 1988), is listed in the Red Data Book of Buryatia (Pronin 1988).

Little Ringed Plover *Charadrius dubius* Scopoli: Several birds were seen regularly in the dunes at the shore of Barguzinskij Bay. Distressed behavior was often observed during July and early August (DH, TK, PS).

indicating the possible presence of nests or young. A juvenile bird was observed there during the first half of August (TK).

Lesser Golden Plover *Pluvialis dominica* (P.L.S. Müller): One adult in breeding plumage with one juvenile was observed on 21 August at the southern Barmašovoe Lake (JM).

Lapwing *Vanellus vanellus* (Linnaeus): Common throughout the wetlands. Rather rare in the 1920s (Štegman 1936).

Sanderling *Calidris alba* (Pallas): Not recorded by us. Gagina (1960) lists this species as a migrant in the area.

Red-necked Stint *Calidris ruficollis* (Pallas): Not recorded by us. This species was recorded as a migrant in the area by Gagina (1960).

Little Stint *Calidris minuta* (Leisler): Observed in late August: on the sandy shores of the central Barmašovoe Lake (9 birds on 21 August, JM; abundant on 22 August, JM) and in the marshes near the eastern hunters' hut (6 birds on 25 August, PS). Štegman (1936) observed several birds and collected two adult males near Usť-Barguzin already on 22 July in 1930, but remarked that they were non-breeding birds.

Sharp-tailed Sandpiper *Calidris acuminata* (Horsfield): Not recorded by us. Gagina (1960) reported on a single bird shot in autumn (month and year not given) at the Svjatoj Nos isthmus.

Sandpiper *Calidris* sp.: Single birds sighted at a canal in the marsh near the base camp on 28 June (PS) and flying above the camp on 18 July (DH, EM, JMa). Unidentified Stints of the pair of closely related species *C. ruficollis/minuta* were observed singly in the marshes east of Kedrovka on 29 July, 30 July and 1 August (TK).

Ruff *Philomachus pugnax* (Linnaeus): Single young males were observed in the marshes east of Kedrovka on 28-29 July and 12 August (TK). Skrjabin and Filonov (1962) mentioned that Ruffs occur in the Svjatoj Nos wetlands during spring migration only. Tolčin (1976a) reported that the species breeds there, without giving any details.

Jack Snipe *Lymnocryptes minimus* (Brünnich): Display voice was heard on 5 July after 11 p.m. at Kedrovka coming from the dead forest at the edge of the marsh (DH). Former records of this species in the NE region of Lake Baikal were confined to two records of single birds in the estuary of the Davša river (Gagina 1958a, Skrjabin and Filonov 1962).

Common Snipe *Gallinago gallinago* (Linnaeus): Very common throughout the marshes (including Lake Arangatuj and Kulinoe), heard at the Barguzin river. Voice and "drumming" were heard often during late June and July (DH, EM, JMa, PS). Breeding was confirmed for the first time by Skrjabin and Filonov (1962).

Pintail Snipe *Gallinago stenura* (Bonaparte): One bird was netted near the base camp on 23 August (PS). Said to be the most common snipe species of the Svjatoj Nos wetlands (Skrjabin and Filonov 1962).

Swinhoe' s Snipe *Gallinago megala* Swinhoe: Not recorded by us. Turov (1924a) found this species breeding in the estuary of the Ongokon river in Čivyrkujskij Bay.

Asiatic Dowitcher *Limnodromus semipalmatus* (Blyth): Both adults and juveniles were regularly observed in the period from 1-14 August in the wetlands east of Kedrovka (TK, JM, PS). At first seen only in the interior parts of the marshes, but later they started to come out to the edges as well. On 7 August, at least 18 birds (both young and adult) were counted at the locality (TK, JM). Often observed in pairs of an adult + a juvenile. Young birds were observed trying to get food from the adults several times. These observations indicate probable breeding of Asiatic Dowitchers in the Svjatoj Nos wetlands, but direct proofs of breeding were not obtained. The species was first observed at NE Baikal in 1922 by Turov (1923). Since then Asiatic Dowitchers have not been recorded in the region until the 1970s, when 4 birds were observed on 25 May 1976 in the delta of the Verchnjaja Angara river, 3 birds in the northern part of Lake Severo-Bajkal'skoe on 24 June 1977, and 2 birds at the same place on 30 May 1978 (Tolčin et al. 1979). These observations led the authors to consider the breeding of the Asiatic Dowitcher in the NE region of Lake Baikal to be probable. On the Svjatoj Nos isthmus, the Asiatic Dowitcher was seen only in 1961 (Skrjabin 1967) prior to our expedition. The nearest previously known breeding place of Asiatic Dowitchers was the delta of the Selenga river, where up to 300 breeding pairs were found (Meľnikov 1979a,b, 1984, 1985, 1990a,b, Vasiľčenko 1987), and the Irkut basin near Irkutsk (Bezborodov 1979, Bogorodskij 1989). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Black-tailed Godwit *Limosa limosa* (Linnaeus): Seen in the marshes east of Kedrovka from 30 July to 14 August (TK, JM, PS). At least one juvenile bird was observed on 10 August (TK) and one on 14 August (TK). The highest number of birds counted per day was 10 on 10 August (TK). The few previous records of this species in the Svjatoj Nos wetlands were limited to autumn migration (Turov 1923, Štegman 1936).

Little Whimbrel *Numenius minutus* Gould: Two birds were observed flying near the base camp on 23 August (PS). Also all previous records of this species in the NE of the Lake Baikal region are confined to August (Anakin 1986). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Eurasian Curlew *Numenius arquata* (Linnaeus): Regularly observed in the marshes near Barguzinskij Bay (less frequently in August). A flock of six birds was seen there on 30 July (TK). Display flight of males was observed in the end of June (DH, PS). An adult with two chicks was found in the dunes near the bay on 28 June (DH). Single birds were seen at Lake Arangatuj near Kordon (9-10 July, DH, EM, JMa) and at Kulinoe (11 August, JM), voice was heard near the Barguzin river (12 July, DH, EM, JMa). This curlew was also previously known to breed in the Svjatoj Nos wetlands (Turov 1923, Malyšev 1960).

Australian Curlew *Numenius madagascariensis* (Linnaeus): One bird was observed flying above the marshes near Kedrovka on 25 August (PS).

Spotted Redshank *Tringa erythropus* (Pallas): Seen and heard in the marshes near Kedrovka: birds in breeding plumage on 6 July - 1 birds (DH), 7 July - 2 birds (DH, EM, JMa); molting birds on 10 August - 3 birds (TK), 14 August - 4 birds (TK). Display voice was heard on 6 July (DH). Five birds in breeding plumage were observed near Kulinoe on 11-12 August (JM, PS). Formerly, the species was known from the Svjatoj Nos wetlands only on autumn migration (late August - early October) when it was said to be common (Turov 1923, Skrjabin and Filonov 1962).

Marsh Sandpiper *Tringa stagnatilis* (Bechstein): Commonly observed in the marshes east of Kedrovka between 29 July and 14 August (TK, JM, LS, PS). At the beginning observed only in the interior parts of the wetlands. On 30 July, 8-10 birds could be seen there simultaneously. Adults from several pairs were distressed, which indicated the presence of young (TK). Later in August the birds started to occur at the edges of the marsh as well. Two juveniles were sighted on 29 July (TK), three were mistnetted on 7 August. Breeding of the Marsh Sandpiper in the Baikal area was thought to be limited to just a few places (Gagina 1962), until Tolčin (1976b) discovered that the species is widely distributed there. The first record for the Svjatoj Nos wetlands is dated on 25 May 1955 (Gagina 1962).

Greenshank *Tringa nebularia* (Gmelin): Mostly single birds were observed and heard in the marshes near Kedrovka from 28 July to 14 August (TK, EM, JM, JMa, LS). The greatest number of birds recorded per day was 8 on 12 August (TK). Voice was heard at Kordon near Lake Arangatuj on 17 August (TK).

Green Sandpiper *Tringa ochropus* Linnaeus: Voice was heard at the Barguzin river on 13 July (DH, EM, JMa) and at a canal in the forest of Kedrovka west of the marshes on 14 July (DH). Single birds were observed at Zmeinaja Bay on 23 July (alarmed behavior, possibly at the nest, DH, EM, JMa) and at Lake Kulinoe on 27 July (DH). Heard and observed several times in August in the marshes east of Kedrovka (3 birds on 10 August, TK; 2 birds on 12 August, TK). Heard and two birds sighted at

Kordon on 17-18 August (TK). The most common sandpiper of the wetlands in summer 1988 according to Jumov (1990). We cannot confirm his report: the Wood Sandpiper was by far the most common during our fieldwork (see also Štegman 1936).

Wood Sandpiper *Tringa glareola* Linnaeus: Common in the marshes near Kedrovka, at Lake Arangatuj (southern and southeastern shores) and at Kulinoe. In the end of June and beginning of July, display voice was heard several times and nesting was indicated by the alarmed behavior of birds in parts of the marshes near Kedrovka (DH, PS).

Terek Sandpiper *Xenus cinereus* (Güldenstädt): Single birds were seen in the marshes near Kedrovka on 8 and 13 August (TK). At least five birds were observed on the grassy shores of the southern Barmašovoe Lake on 21 August (JM). Formerly known to breed on small taiga lakes near Usť-Barguzin (Štegman 1936). Later reported from NE Baikal only on autumn migration, between 30 July and 22 August (Skrjabin and Filonov 1962)

Common Sandpiper *Actitis hypoleucos* Linnaeus: Common at the Barmašovye Lakes and along the shore of Barguzinskij and Čivyrkujskij Bays.

Grey-rumped Sandpiper *Heteroscelus brevipes* (Vieillot): One bird was encountered on the shore of Čivyrkujskij Bay between Kresty and Zmeinaja Bay on 23 July (DH, EM, JMa).

Ruddy Turnstone *Arenaria interpres* (Linnaeus): One bird was sighted in the marshes between Kedrovka and the hunters' huts on 25 August (PS).

Little Gull *Larus minutus* Pallas: Observed several times above the marsh near Kedrovka, sometimes catching insects in the air. A nesting colony of approximately 10 pairs with hatchlings in the nests was found at a Black-headed Gull colony in the marshes east of Kedrovka (28 June, PS). The most common gull at the southern shore of Lake Arangatuj (over 30 birds on 12 July, DH, EM, JMa). Breeding of Little Gulls in the Svjatoj Nos wetlands was first confirmed in 1979, when a colony of 10-12 breeding pairs was found (Egorov 1980). The species is possibly spreading over Buryatia, because its first breeding was confirmed there only in 1974 on Lake Boľšoe Eravnoe (Škatulova 1979).

Black-headed Gull *Larus ridibundus* Linnaeus: Abundant in the wetlands and at the Barguzin river. Nesting colonies were found in the marshes. According to Štegman (1936), Black-headed Gulls visited the eastern coast of Lake Baikal in autumn only. In the late 1950s, the species was already known to breed at Lake Arangatuj (Skrjabin and Filonov 1962, Egorov 1980).

Common Gull *Larus canus* Linnaeus: Single birds in flocks of Herring Gulls in Barguzinskij Bay and the Barguzin river. A maximum of 30 adults was observed above Čivyrkujskij Bay near Golaja Gora on 3-5 August (TK). Egorov (1980) reported that approximately 90 pairs of Common Gulls bred on Lake Arangatuj in the late 1970s. Former breeding of Common Gulls at this locality was reported by Gusev (1960) and Skrjabin and Filonov (1962).

Herring Gull *Larus argentatus* Pontoppidan: Abundant throughout the wetlands and at the Barguzin river. A nesting colony was found on Malyj Kaltugej island in Čivyrkujskij Bay (AR). Breeding of this species on islands in Čivyrkujskij Bay has been known for several decades (Malyšev 1960, Skrjabin and Filonov 1962, Pyž' janov et al. 1989). Two breeding colonies of the Herring Gull were known there in the late 1970s, with approximately 900 and 150 pairs, respectively (Egorov 1980). We made no exact estimation of the Herring Gull population in the area, but the numbers were apparently lower. It was interesting to see that only adult (breeding) birds and first-year young were present in the area, while second-year adolescent birds were entirely absent.

Caspian Tern *Sterna caspia* Pallas: One bird was recorded above Barguzinskij Bay near the base camp on 2 August (JM). A flock of 4 terns was observed flying high above the Barguzin river at Usť-Barguzin on 21 August (TK). Caspian Terns were observed at NE Baikal for the first time in 1973 (Tolčin et al. 1974). Since then, single individuals have been repeatedly observed in the region (Sadkov 1977, Meľnikov 1979b, B.O. Jumov, pers. communication), but breeding has not been confirmed yet.

Common Tern *Sterna hirundo* Linnaeus: Common. Observed throughout the wetlands and at the Barguzin river. On 28 June, a mixed nesting colony (together with White-winged Black Terns) was discovered east of Kedrovka near a Black-headed Gull colony (PS). Hatchlings were found in most of the nests. The Common Tern was regarded as a common breeder of the Svjatoj Nos wetlands in the 1950s (Gagina 1960, Gusev 1960). In 1979, its breeding status was estimated at approximately 70 pairs (Egorov 1980).

White-winged Black Tern *Chlidonias leucopterus* (Temminck): Abundant, flying above the marshes throughout the isthmus. On 12 July a flock of 120 birds was observed mobbing a Goshawk at the southern shore of Lake Arangatuj (DH, EM, JMa). Marshes in the wider vicinity of Kedrovka were frequented by 50-70 White-winged Black Terns on 1 August (TK, JM, PS). Hatchlings were found in a nesting colony in marshes east of Kedrovka on 28 June (PS), adults feeding juveniles were observed in August. Generally, the numbers of these terns decreased during August (TK, JM, PS).

Rock Dove *Columba livia* Gmelin: Not recorded by us. Observed by Jumov (1990) in summer 1988 at human settlements at Čivyrkujskij Bay.

Eastern Rock Dove *Columba rupestris* Pallas: Common at a farm near the entrance to the park and in the village of Kurbulik, where they ecologically replace domestic pigeons. Urbanization of the Eastern Rock Dove is now a widespread phenomenon over its range (Veržuckij 1969, Pyž' janov 1986; see also Doržiev 1979, 1985).

Rufous Turtle Dove *Streptopelia orientalis* (Latham): Common in forested areas of the isthmus and at Čivyrkujskij Bay. Usually only single doves, but sometimes up to four were seen together.

Cuckoo *Cuculus canorus* Linnaeus: Heard and observed in the forest near Kordon (9-12 July, DH, EM, JMa).

Oriental Cuckoo *Cuculus saturatus* Blyth: Once heard in the forest at the road from Glinka to Monachovo on 3 July (DH), several times heard near Kordon (10-11 July, DH, EM, JMa).

Eagle Owl *Bubo bubo* (Linnaeus): Voice was heard shortly after midnight on 10/11 August from Kovrižka hill (JM, PS) and a feather was found at Kedrovka on 9 August (PS). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Hawk Owl *Surnia ulula* (Linnaeus): Not recorded by us. Reported by Gagina (1960) from summer (details not given). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Tengmalm' s Owl *Aegolius funereus* (Linnaeus): One adult bird was flushed at the edge of a forest near Lake Kulinoe on 25 July (DH, EM, JMa). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Needle-tailed Swift *Hirundapus caudacutus* (Latham): Single birds seen flying high above the forest near Kordon on 11 July (DH, EM, JMa) and on 17-18 August (TK, PS) and at Kresty on 23 July (DH, EM, JMa). Formerly recorded in the region by Štegman (1936) in July 1930 and by Jumov (1990) in summer 1988.

Swift *Apus apus* (Linnaeus): Commonly seen above forests both on the side of the peninsula and the mainland (see also Skrjabin and Filonov 1962).

Fork-tailed Swift *Apus pacificus* (Latham): Flocks of as many as 40 birds were seen high above the marshes near Kedrovka in the end of June and in early July. Common at Čivyrkujskij Bay, where nesting colonies were found on cliffs along the shore from Monachovo to Kresty (see also Gusev 1960). Also seen above Kulinoe. Not observed in August. Found to be common already in the times of Turov (1923) and Štegman (1936).

Kingfisher *Alcedo atthis* (Linnaeus): Seen at Samovo Lake on 7 August (TK, LS).

Hoopoe *Upupa epops* Linnaeus: Sighted near Kedrovka in a belt of bushes and trees growing along the shore of Barguzinskij Bay on 16 July (AR) and 12 August (TK). Also seen in a dead forest west of the Barmašovye Lakes on 6 August (FF, ML). Skrjabin (1967) mentioned that Hoopoes were formerly rare in the region of NE Lake Baikal, but started to be more frequently observed in the 1960s. Observed at Kulinoe in summer 1988 by Jumov (1990).

Wryneck *Jynx torquilla* Linnaeus: A single bird was observed on 23 August (PS) and mistnetted on 25 August (JM) at Kedrovka.

Black Woodpecker *Dryocopus martius* (Linnaeus): Seen in the pine forest of Kedrovka on 17 July (RS) and in the forests near Kordon on 17-19 August (TK, PS).

Great Spotted Woodpecker *Dendrocopos major* (Linnaeus): Common in the forests throughout the studied area. Approximately 20 nesting holes with young birds were recorded in the end of June and in July (DH, EM, JMa, PS).

Lesser Spotted Woodpecker *Dendrocopos minor* (Linnaeus): One male was found at a nesting hole with young at Kordon on 10 July (DH, EM, JMa), two birds were seen at Kordon on 17 August (TK). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Northern Three-toed Woodpecker *Picoides tridactylus* (Linnaeus): Occasionally seen in the pine forest of Kedrovka (female on 1 July, DH; male on 15 July, DH, EM, JMa; female on 8 August, JM, PS; female? on 25 August, JM). Approximately 5 birds were observed on 19 August in the forests at Kordon (TK, LS).

Mongolian Lark *Melanocorypha mongolica* (Pallas): A single vagrant was observed on the road leading through the dunes along Barguzinskij Bay on 7 July (DH, EM, JMa). The species has not been observed at central and northern Baikal before (B.O. Jumov, pers. communication).

Skylark *Alauda arvensis* Linnaeus: Not observed by us. Recorded only by Jumov (1990) in summer 1988.

Sand Martin *Riparia riparia* (Linnaeus): A few individuals were seen in a large flock of swallows above the marshes at Kulinoe on 11 August (JM).

Barn Swallow *Hirundo rustica* Linnaeus: Found nesting at human settlements in the studied area. Often seen flying along the shore of Barguzinskij Bay in July (probably birds from Glinka). Last Barn Swallows disappeared from Kordon on 24 August (ML).

House Martin *Delichon urbica* (Linnaeus): A few individuals were seen in a large flock of swallows above the marshes at Kulinoe on 11 August (JM).

Richard' s Pipit *Anthus novaeseelandiae* (Gmelin): Common at the pastures at Kulinoe (25-27 July, DH, EM, JMa). Not observed there on 10-12 August any more (JM). A common bird in the Svjatoj Nos wetlands 30 years ago (Skrjabin and Filonov 1962), uncommon in summer 1988 (Jumov 1990).

Indian Tree Pipit *Anthus hodgsoni* Richmond: Several birds heard and observed in the forest along the road from Glinka to Monachovo on 3 July (DH). Single sightings at Golaja Gora on 5 August (TK, JM) and at Kulinoe on 11 August (JM).

Tree Pipit *Anthus trivialis* (Linnaeus): Common in forests or places with scattered trees. Turov (1923) and Štegman (1936) found only *Anthus hodgsoni* near Usť-Barguzin and the species was unknown at NE Baikal even three decades ago (Skrjabin and Filonov 1962). In summer 1988, Jumov (1990) commonly observed *Anthus trivialis* in the forests of the Zabajkaľskij National Park.

Yellow Wagtail *Motacilla flava* Linnaeus: Single birds seen at the edge of the marshes near Barguzinskij Bay on 14 July (DH, EM, JMa), and at Kulinoe on 11 August (JM). Starting from 18 August, Yellow Wagtails were regularly, though in small numbers, seen and mistnetted at Kedrovka (JM). The species was considered rare in the Svjatoj Nos wetlands also 30 years ago (Skrjabin and Filonov 1962).

Yellow-headed Wagtail *Motacilla citreola* Pallas: Common at Lake Arangatuj (adults and young), single birds were seen in the marshes near Kedrovka and at the Barguzin river in July and the beginning of August (DH, TK, JM, PS). Very common in flocks of White Wagtails near the shore of Barguzinskij Bay at the end of August (JM, PS).

Grey Wagtail *Motacilla cinerea* Tunstall: Common along the shore of Čivyrkujskij Bay. One pair each at the creek Kurtuj and at the creek at Kordon. An adult male was mistnetted at the base camp on 28 August (JM).

White Wagtail *Motacilla alba* Linnaeus: Common in the Svjatoj Nos isthmus and at Čivyrkujskij Bay, but avoiding the interior of marshes and forests. Juvenile birds were seen often. Abundant near the shore of Barguzinskij Bay on migration in the second half of August (JM, PS).

Bohemian Waxwing *Bombycilla garrulus* (Linnaeus): Seen in the forests at Kordon: one pair on 10 July (DH, EM, JMa) and several birds during 17-20 August (TK, PS).

Siberian Rubythroat *Luscinia calliope* (Pallas): Common in bushy areas (e.g. along the shore of Barguzinskij Bay) and in forests with rich undergrowth. Nesting was indicated twice (DH, EM, JMa): near the base camp on 8 July (by the alarmed behavior of a female) and at Kordon on 10 July (an alarmed male carrying food).

Siberian Blue Robin *Luscinia cyane* (Pallas): Recorded on 2 August in the taiga south of Kurbulik (1 juv., ML), on 11 August at Kulinoe (1 ad., JM) and on 12 August SE of Kedrovka in the belt of bushes and trees growing along Barguzinskij Bay (1 male, TK).

Red-flanked Bluetail *Tarsiger cyanurus* (Pallas): Common in forests, but more often heard than seen. An adult bird feeding a juvenile was observed north of Monachovo on 2 July (DH).

Daurian Redstart *Phoenicurus auroreus* (Pallas): Single males were seen at Kedrovka on 30 June (DH, PS), and at Monachovo on 22 and 25 July (DH, EM, JMa). A female and a male were seen at Kordon on 12 July (DH, EM, JMa) and 19 August (TK), respectively. A male carrying food was observed at a forest clearing overgrown with bushes south of Kordon on 11 July (DH, EM, JMa).

Stonechat *Saxicola torquata* (Linnaeus): Observed near the edge of the marshes at Kordon on 9 July (1 pair, DH, EM, JMa), 14 July (2 pairs feeding young, PS), 17 August (1 juv. male mistnetted, PS), at Kulinoe on 25-26 July (1 pair, DH, EM, JMa) and at Kedrovka on 16 August (JM).

Isabelline Wheatear *Oenanthe isabellina* (Temminck): An immature bird was seen several times near the base camp in the dunes and in the dead forest on 13-16 July (DH, EM, JMa, PS). A single bird was observed on sandy patches in the marshes near the Barmašovye Lakes on 23 August (JM, LS). Northern limits of the distribution of the Isabelline Wheatear were at southernmost Baikal a few decades ago, but since the late 1950s, a spreading tendency toward the north has been observed in the region (Malyšev 1960, Gusev 1962, Skrjabin and Filonov 1962, Žarov 1967).

Northern Wheatear *Oenanthe oenanthe* (Linnaeus): Not recorded by us. Observed in summer 1988 at Kulinoe (Jumov 1990).

Scaly Thrush *Zoothera dauma* (Latham): One bird was seen in the marshes near the western hunters' hut on 24 August (PS). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Dark-throated Thrush *Turdus ruficollis* Pallas: A flock of approximately 10 individuals was seen in patches of taiga in the marshes near the southern Barmašovoe Lake on 23 August (JM, LS).

Red-winged Thrush *Turdus iliacus* Linnaeus: A small flock was observed flying above the taiga near the Barmašovye Lakes on 22 August (JM).

Pallas' s Grasshopper Warbler *Locustella certhiola* (Pallas): Abundant throughout the marshes. An adult bird with three juveniles was observed SE of Kedrovka on 12 August (TK).

Lanceolated Grasshopper Warbler *Locustella lanceolata* (Temminck): Its voice was regularly heard coming usually late in the evening from a canal in the dead forest at Kedrovka on 27 June - 14 July (DH, EM, JMa, PS). Several birds were heard and seen in the wet meadows near the park entrance on 12-13 July (DH, EM, JMa). Common in the marshes at Golaja Gora and at Kulinoe (JM, PS).

Gray' s Grasshopper Warbler *Locustella fasciolata* (Gray): Not recorded by us. A rare, possibly breeding bird according to Gagina (1960). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Thick-billed Reed Warbler *Acrocephalus aedon* (Pallas): A single bird was mistnetted at Kedrovka on 18 August (JM). Only one record of this species from northern Baikal was known to Štegman (1936).

Lesser Whitethroat *Sylvia curruca* (Linnaeus): Observed several times in the belt of bushes and trees along Barguzinskij Bay and near the park entrance. A few birds in a mixed tit-flock at Kulinoe on 11 August (JM).

Greenish Warbler *Phylloscopus trochiloides* Sundevall: Common in the forests between Glinka and Monachovo and at the entrance of the park. Unlike most authors, Voous (1977) elevated the Two-barred Greenish Warbler *Phylloscopus trochiloides plumbeitarsus* Swinhoe to the species rank. We have not distinguished between these species in the field due to the lack of identification hints.

Arctic Warbler *Phylloscopus borealis* (Blasius): First individuals appeared at Kedrovka on 24 August (JM). In subsequent days, the species was mistnetted several times (JM, PS).

Inornate Leaf Warbler *Phylloscopus inornatus* (Blyth): Several times seen in the forests near Glinka, Kresty and Kulinoe. Single birds were mistnetted at Kedrovka on 8 July (DH, EM, JMa, PS), and on 23-27 August (JM, PS).

Dusky Warbler *Phylloscopus fuscatus* (Blyth): Common in a small heathy area with scattered bushes and small trees (mainly pines and birches) between Kordon and Lake Arangatuj on 9-15 July (DH, EM, JMa, PS). Several birds carrying food were observed there. Out of four birds mistnetted on 10 July three were this year' s young.

Sooty Flycatcher *Muscicapa sibirica* Gmelin: Several birds were seen in the forests near Glinka and Kresty in the second half of July (DH, EM, JMa), and single birds were observed at Kedrovka on 7 August (JM) and at Kordon on 19 August (PS). An adult bird was observed feeding a juvenile on 24 July near Kresty (DH, EM, JMa).

Asian Brown Flycatcher *Muscicapa latirostris* Raffles: A pair was seen feeding two juveniles in the forest south of Kordon on 11 July (DH, EM, JMa). A single bird was observed at Kulinoe on 26 July (DH).

Red-breasted Flycatcher *Ficedula parva* (Bechstein): Common in the forests of the studied area. A pair at a nesting hole was found on 10 July north of Kordon (DH, EM, JMa). Juvenile birds were seen several times in the second half of July (DH, EM, JMa): one juv. with a male on 15 July north of Glinka, one juv. with a female on 24 July SE of Kresty, and two juv. on 26 July at Kulinoe.

Long-tailed Tit *Aegithalos caudatus* (Linnaeus): Flocks were occasionally seen in the bushes at the edge of a pine forest at Kedrovka. Also seen along the road from Glinka to Monachovo on 3 July (DH). Dominant in a mixed flock of approximately 70 tits, nuthatches and warblers observed on 11 August at Kulinoe (JM).

Marsh Tit *Parus palustris* Linnaeus: A few individuals, possibly a family, were observed in the taiga near Golaja Gora on 5 August (JM), 2 birds at Kedrovka on 7 August (TK, LS), several birds in a mixed tit-flock at Kulinoe on 11 August (JM).

Willow Tit *Parus montanus* Conrad: Common in forests throughout the studied area. Several flocks with young were observed in July (DH, EM, JMa).

Coal Tit *Parus ater* Linnaeus: Common in forests throughout the studied area. A nesting hole was found south of Monachovo on 3 July (DH), flocks with young were seen several times in July (DH, EM, JMa).

Azure Tit *Parus cyanus* Pallas: Not recorded by us. Tarasov (1934) observed this species on the Svjatoj Nos isthmus. This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Great Tit *Parus major* Linnaeus: Observed several times at Monachovo (a pair with three young on 25 July, DH, EM, JMa). A few birds, both adults and freshly fledged juveniles, were seen in a mixed flock of tits, nuthatches and warblers on 11 August at Kulinoe (JM). Great Tits were unknown from central and northern Baikal in the 1920s (Turov 1924a,b, Štegman 1936).

Eurasian Nuthatch *Sitta europaea* Linnaeus: Common in forests throughout the studied area.

Common Tree Creeper *Certhia familiaris* Linnaeus: Seen on 3 July along the road from Glinka to Monachovo (DH) and on 25 July at Kulinoe (DH, EM, JMa). Observed in Zmeinaja Bay in August 1984 and in the surroundings of Monachovo in summer 1988 (Jumov 1990). This species is listed in the Red Data Book of Buryatia (Pronin 1988).

Brown Shrike *Lanius cristatus* Linnaeus: Common at Kordon, at edges of the pine forest and in the dead forest at Kedrovka. Also observed at Lake Krestovskoe on 24 July (DH, EM, JMa). A nest with five eggs was found in the dead forest on 16 July (DH, EM, JMa, PS). In the beginning of July, shrikes were several times observed, being mobbed by small passerines, mainly White Wagtails and Yellow-breasted Buntings, at Kedrovka (DH).

Jay *Garrulus glandarius* (Linnaeus): Not recorded by us. Known as a summer visitor on the isthmus to Gagina (1960).

Siberian Jay *Perisoreus infaustus* (Linnaeus): One bird was seen at a small heathy area with scattered bushes and trees between Kordon and Lake Arangatuj on 10 July (EM, JMa). Occasionally observed in the pine forest of Kedrovka: 14 July (5 birds, DH, EM, JMa), 16 July (3 birds, DH, EM, JMa), 9 August (3 birds, JM), 13 August (4 birds, TK), 25 August (2 birds, JM).

Azure-winged Magpie *Cyanopica cyana* (Pallas): Not recorded by us. Gagina (1960) listed this bird as a vagrant to the Svjatoj Nos isthmus.

Black-billed Magpie *Pica pica* (Linnaeus): A single magpie was seen in the pine forest near the park entrance on 7 August (PS).

Nutcracker *Nucifraga caryocatactes* (Linnaeus): Commonly heard and seen in forests. Sometimes flocks were observed, e.g. 60 birds above the base camp on 28 July (DH, TK, EM, JMa), and 33 birds at the same place on 20 August (JM).

Crow *Corvus corone* Linnaeus: Common throughout the studied area (see also Turov 1923). Two families with young were observed near the base camp in the end of June (DH, PS).

Northern Raven *Corvus corax* Linnaeus: Both adult and young birds were observed between 17-20 August feeding on pine nuts in the forest south of Kordon (TK, LS, PS). Occasionally observed near the shore of Barguzinskij Bay.

House Sparrow *Passer domesticus* (Linnaeus): Common at human settlements: in Monachovo, Kurbulik and at the farm near the park entrance. Rare and only locally distributed at northern Baikal in the 1920s (Turov 1923, Štegman 1936).

Tree Sparrow *Passer montanus* (Linnaeus): Common in Monachovo and at the farm near the park entrance. A flock was seen in bushes at the edge of the marsh near Barguzinskij Bay southeast of the base camp on 14 July (DH, EM, JMa). Flocks were encountered more often along the shore of the bay in the course of August (TK, JM, PS). Rare and only locally distributed at northern Baikal in the 1920s (Turov 1923, Štegman 1936).

Brambling *Fringilla montifringilla* Linnaeus: Heard often, single birds and pairs seen in forests of the studied area. A male was observed carrying food near Glinka on 19 July (DH).

Siskin *Carduelis spinus* (Linnaeus): Common in the forests of the studied area. A flock of approximately 200 juvenile birds was encountered in the forest south of Kordon on 19 August (PS). Siskins were rare in Buryatia until the middle of the 20th century, when they began to expand their range (Izmajlov and Prokof' ev 1953).

White-winged Crossbill *Loxia leucoptera* Gmelin: Two pairs were observed on 30 June feeding in a pine tree at Kedrovka (DH).

Red Crossbill *Loxia curvirostra* Linnaeus: Common in forests throughout the studied area.

Common Rosefinch *Carpodacus erythrinus* (Pallas): Single males wandered near the base camp in the beginning of July (DH) and on 12 August (TK). One male was observed singing in a willow thicket in Monachovo on 2 July (DH). One bird was mistnetted at Kordon on 19 August (TK, LS, PS).

Eurasian Bullfinch *Pyrrhula pyrrhula* (Linnaeus): One pair was seen in the forest south of Kordon on 11 July (DH, EM, JMa).

Hawfinch *Coccothraustes coccothraustes* (Linnaeus): Not recorded by us. Reported by Gagina (1960) from autumn (details not given).

Black-faced Bunting *Emberiza spodocephala* Pallas: A pair was observed carrying food at the edge of a pine and birch forest near the wet meadows at the park entrance on 12-13 July (DH, EM, JMa). Formerly recorded from the Svjatoj Nos wetlands by Jumov (1990) in summer 1988 as a rare bird.

Pine Bunting *Emberiza leucocephalos* S.G. Gmelin: Not recorded by us. A summer visitor according to Gagina (1960).

Yellow-browed Bunting *Emberiza chrysophrys* Pallas: A pair was disturbed (obviously near the nest - both birds were carrying food) at the edge of a pine forest with rich undergrowth along the road from Glinka to Monachovo east of the creek Burtuj on 3 July (DH). Two males were seen at the creek on 27 July (DH, EM, JMa). Jumov (1990) found a family with young at the creek on 14 July 1988.

Little Bunting *Emberiza pusilla* Pallas: Not recorded by us. Said to occur in the Svjatoj Nos wetlands during autumn migration by Gagina (1960) without further specification.

Chestnut Bunting *Emberiza rutila* Pallas: Observed several times in the forests between Glinka and Kulinoe in July (DH, EM, JMa). Two juveniles were mistnetted near Glinka on 19 July (DH, EM, JMa). A male with several female-colored birds was observed at Kedrovka on 19 August (JM).

Yellow-breasted Bunting *Emberiza aureola* Pallas: Abundant in open and semi-open habitats, such as marshes, areas with scattered bushes and trees, forest edges, and clearings. Five nests were found built on the ground hidden under grass. The first one was found with five eggs on 25 June at the base camp (DH, PS). The five nestlings, first seen on 28 June, left the nest still flightless on 7 July (DH). A second nest with five nestlings was located in the dead forest at Kedrovka (DH). Three of them were found dead in the abandoned nest two days later. The third nest, found on 6 July at the base camp with five fledged young, was empty the next day (DH). Two more nests were found with three and four eggs, respectively, on 14 July at the edge of the marsh southeast of the camp (DH, EM, JMa). A female carrying food was observed on 6 August at Kedrovka (JM).

Reed Bunting *Emberiza schoeniclus* (Linnaeus): Three molting birds were seen at the shore of Lake Arangatuj near Kordon on 17 August (TK). Recorded by Jumov (1990) in 1988.

Pallas' s Reed Bunting *Emberiza pallasi* (Cabanis): Not recorded by us until 19 August, when a male and several female-colored birds were observed at Kedrovka (JM). During the following days (till the end of our fieldwork on 28 August), Pallas' s Reed Buntings were abundant at the locality. The species was known formerly only as an autumn migrant at NE Baikal, with peak migration between late September and early October (Skrjabin and Filonov 1962). The earliest date of observation was 10 August (Malyšev 1960).

Discussion

According to the studied literature 137 bird species had been reported from the Svjatoj Nos isthmus and the western shore of Čivyrkujskij Bay prior to our expedition. We recorded 145 species during our fieldwork. 44 of them were new to the area, raising the total number of known species to 177. The breeding of 46 species has been confirmed by us (Sharrock' s categories D10-D16) and for further a 22 species breeding could be classified as probable (categories C3-C9).

Comparing the results of our fieldwork with the reports of earlier authors we found evidence of changes in the avifauna of the region. At least 12 species have spread to the area during the last half century, including Great Crested Grebe, Red-necked Grebe, Black Duck (but see below), Smew, Asiatic Dowitcher, Marsh Sandpiper, Little Gull, White-winged Black Tern, Tree Pipit, Isabelline Wheatear, Great Tit, and Siskin.

On the other hand, several species of birds have probably disappeared from the Svjatoj Nos area during last decades. In particular, this applies to the following species: Great Cormorant, Bittern, Falcated Teal, Goosander, Black Grouse, Common Quail, Japanese Quail, and European Coot. The Whooper Swan, the Ruddy Shelduck, the Gadwall, the Northern Shoveler, the Tufted Duck, the White-tailed Eagle, the Pintail Snipe, and the Herring Gull were formerly recorded as common species, but our observations indicate that their populations have decreased.

The Black Duck, which has extended its range to northern Lake Baikal from the southeast since the 1950s (Skrjabin 1965, 1975), was not found by us. This may indicate that it has disappeared again. A similar fate could have met the Red-footed Falcon, which was recorded on the Svjatoj Nos isthmus as a common bird in 1988 (Jumov 1990), but has not been recorded in the locality (which is beyond the eastern border of the species' area in Siberia) before or after that year.

Reasons for the changes are mostly unknown due to lack of detailed information. In two of the disappeared species (Great Cormorant and European Coot), the direct effect of man, particularly hunting and disturbance at breeding colonies, was the probable cause of their decline (Egorov 1980, Vasil'čenko and Prokop' ev 1988a). The distribution of others could have been influenced by the changes in habitats and water regime which followed the rise of the water level caused by the Irkutsk dam in 1962 (Logačev 1976, Florensov 1977). Although direct evidence is not available, it can be inferred from the changes in vegetation on the Svjatoj Nos isthmus that large parts of the isthmus were flooded by that event which restricted the available area of open unflooded land, required by such former inhabitants of the isthmus, as Black Grouse, and both quail species.

The importance of the Svjatoj Nos wetlands for the protection of Siberian birds appears to be great. Of the 72 bird species listed in the Red Data Book of Buryatia (Pronin 1988), 30 have been recorded in the Svjatoj Nos wetlands. Moreover, ten of these species (*Ciconia nigra*, *Haliaeetus leucoryphus*, *Haliaeetus albicilla*, *Aquila chrysaetos*, *Pandion haliaeetus*, *Falco cherrug*, *Falco peregrinus*, *Grus monacha*, *Limnodromus semipalmatus*, and *Numenius minutus*) are also listed in the Red Data Book of the USSR (Borodin 1984). For a more detailed account of the conservational significance of the Svjatoj Nos wetlands see Mlíkovský and Stýblo (1992).

Summary

(1) 145 species of birds, including 40 new to the area, were observed on the Svjatoj Nos isthmus and adjacent parts of Čivyrkujskij Bay between

late June and the end of August 1991. This raised the number of avian species known from the area to a total of 177.

(2) At least 12 species of birds have extended their areas to the Svjatoj Nos isthmus during the last half century, while at least 9 species have disappeared from the area during the same period.

(3) Of the birds reported from the Svjatoj Nos wetlands, 30 species are listed in the Red Data Book of Buryatia, and 10 species are listed in the Red Data Book of the (former) USSR.

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Appendix.

List of birds observed in the Svjatoj Nos wetlands, Lake Baikal.

Species	A	B	C	D
Gavia stellata	1	1	2	B2
Gavia arctica	1	1	1	D15
Podiceps cristatus	-	1	1	D12
Podiceps grisegena	-	1	1	D12
Podiceps auritus	-	2	2	B1
Phalacrocorax carbo	1	1	-	-
Botaurus stellaris	1	1	-	-
Ardea cinerea	1	1	1	D16
Ciconia nigra	-	2	2	B1

Cygnus cygnus	1	1	2	C3
Anser cygnoides	5	5	-	-
Anser fabalis	3	3	-	-
Anser sp.	-	-	2	B1
Tadorna ferruginea	1	1	2	C3
Anas penelope	1	1	2	B1
Anas falcata	1	1	-	-
Anas strepera	1	1	2	B1
Anas formosa	-	2	-	-
Anas crecca	1	1	2	C3
Anas platyrhynchos	1	1	2	C3
Anas poecilorhyncha	-	1	-	-
Anas acuta	1	1	1	D12
Anas querquedula	1	1	2	B1
Anas clypeata	1	1	1	D12
Aythya ferina	1	1	1	D12
Aythya fuligula	1	1	2	C3
Histrionicus histrionicus	-	3	-	-
Melanitta fusca	1	1	2	B1
Bucephala clangula	3	1	1	D12
Mergus albellus	-	1	1	D16
Mergus serrator	2	1	2	B1
Mergus merganser	2	1	-	-
Milvus migrans	1	1	2	C3
Haliaeetus leucoryphus	-	2	2	B1
Haliaeetus albicilla	1	1	1	D16
Circus aeruginosus	1	1	2	B1
Circus cyaneus	1	1	2	B1
Accipiter gentilis	-	3	2	B1
Accipiter nisus	-	2	-	-
Buteo buteo	3	3	2	B1
Aquila clanga	-	-	2	B1
Aquila chrysaetos	2	2	2	B1
Pandion haliaetus	1	1	2	C3
Falco tinnunculus	1	1	2	B1
Falco vespertinus	-	2	-	-
Falco subbuteo	2	2	2	C3
Falco cherrug	-	-	2	B1
Falco peregrinus	-	2	-	-
Bonasa bonasia	1	1	1	D12

Lagopus lagopus	-	4	-	-
Tetrao tetrix	-	1	-	-
Coturnix coturnix	-	2	-	-
Coturnix japonica	1	1	-	-
Porzana pusilla	-	1	1	D12
Porzana sp.	-	-	2	B1
Fulica atra	1	1	-	-
Grus grus	1	1	1	D12
Grus monacha	-	2/3	2/3	B1
Otis tarda	-	5	-	-
Charadrius dubius	2	2	1	D12
Pluvialis dominica	-	-	3	-
Vanellus vanellus	-	1	2	B1
Calidris alba	3	3	-	-
Calidris ruficollis	3	3	-	-
Calidris minuta	3	3	3	-
Calidris acuminata	3	3	-	-
Philomachus pugnax	3	1	2/3	B1
Lymnocryptes minimus	-	-	2	B2
Gallinago gallinago	3	1	2	C5
Gallinago stenura	3	2	2/3	B1
Gallinago megala	1	1	-	-
Limnodromus semipalmatus	-	2	2/3	B1
Limosa limosa	3	3	2/3	B1
Numenius minutus	-	-	3	-
Numenius arquata	1	1	1	D12
Numenius madagascariensis	-	-	3	-
Tringa erythropus	3	3	2	B2
Tringa stagnatilis	3	1	2	C7
Tringa nebularia	3	3	2/3	B1
Tringa ochropus	1	1	2	C7
Tringa glareola	1	1	2	C7
Xenus cinereus	-	3	3	-
Actitis hypoleucos	1	1	2	C7
Heteroscelus brevipes	3	3	3	-
Arenaria interpres	3	3	3	-
Larus minutus	1?	1	1	D16
Larus ridibundus	1	1	1	D16
Larus canus	1	1	2	B1
Larus argentatus	1	1	1	D16

Sterna caspia	-	2	2/3	B1
Sterna hirundo	1	1	1	D16
Chlidonias leucopterus	-	1	1	D16
Columba livia	-	2	-	-
Columba rupestris	-	2	2	B1
Streptopelia orientalis	2	2	2	C3
Cuculus canorus	-	-	2	B2
Cuculus saturatus	-	-	2	B2
Bubo bubo	-	-	2	B2
Surnia ulula	2	2	-	-
Aegolius funereus	-	-	2	B1
Hirundapus caudacutus	2	2	2	B1
Apus apus	2	2	2	B1
Apus pacificus	2	1	1	D14
Alcedo atthis	-	-	2	B1
Upupa epops	-	2	2	B1
Jynx torquilla	-	-	3	-
Dryocopus martius	2	2	2	B1
Dendrocopos major	1	1	1	D16
Dendrocopos minor	1	1	1	D16
Picoides tridactylus	-	-	2	B1
Melanocorypha mongolica	-	-	5	A0
Alauda arvensis	-	2	-	-
Riparia riparia	-	-	3	-
Hirundo rustica	-	2	1	D16
Delichon urbica	-	2	3	-
Anthus novaeseelandiae	1	1	2	B1
Anthus hodgsoni	1	1	2	B2
Anthus trivialis	-	-	2	B2
Motacilla flava	-	-	2/3	B1
Motacilla citreola	1	1	1	D12
Motacilla cinerea	2	2	2	C3
Motacilla alba	1	1	1	D12
Bombycilla garrulus	-	-	2	C3
Luscinia calliope	-	-	1	D14
Luscinia cyane	-	-	1	D12
Tarsiger cyanurus	-	3	1	D14
Phoenicurus auroreus	1	1	1	D14
Saxicola torquata	-	-	1	D14
Oenanthe isabellina	2	2	2	A0

Oenanthe oenanthe	-	2	-	-
Zoothera dauma	3	3	3	-
Turdus ruficollis	-	-	3	-
Turdus iliacus	-	-	3	-
Locustella certhiola	1	1	1	D12
Locustella lanceolata	-	-	2	B2
Locustella fasciolata	2	2	-	-
Acrocephalus aedon	-	-	3	-
Sylvia curruca	-	-	2	B2
Phylloscopus trochiloides	-	-	2	B2
Phylloscopus borealis	-	-	3	-
Phylloscopus inornatus	1	1	2	B2
Phylloscopus fuscatus	1	1	1	D14
Muscicapa sibirica	1	1	1	D14
Muscicapa latirostris	-	-	1	D14
Ficedula parva	1	1	1	D14
Aegithalos caudatus	3	3	2	B1
Parus palustris	-	-	2	B1
Parus montanus	1	1	1	D12
Parus ater	-	-	1	D13
Parus cyanus	5	5	-	-
Parus major	2	2	1	D12
Sitta europaea	2	2	2	C3
Certhia familiaris	3	2	2	B1
Lanius cristatus	1	1	1	D15
Garrulus glandarius	2	2	-	-
Perisoreus infaustus	2	2	2	C3
Cyanopica cyana	5	5	-	-
Pica pica	-	-	2	B1
Nucifraga caryocatactes	3	3	2	B1
Corvus corone	1	1	1	D12
Corvus corax	-	2	2	B1
Passer domesticus	-	2	2	B1
Passer montanus	2	2	2	B1
Fringilla montifringilla	-	-	1	D14
Carduelis spinus	-	-	2	C3
Loxia leucoptera	-	-	2	C3
Loxia curvirostra	-	-	2	C3
Carpodacus erythrinus	-	-	2	B2
Pyrrhula pyrrhula	-	-	2	C3

Coccothraustes coccothraustes	3	3	-	-
Emberiza spodocephala	-	2	1	D14
Emberiza leucocephalos	2	2	-	-
Emberiza chrysophrys	-	1	1	D14
Emberiza pusilla	3	3	-	-
Emberiza rutila	1	1	1	D12
Emberiza aureola	1	1	1	D16
Emberiza schoeniclus	-	2	3	-
Emberiza pallasi	3	3	3	-

A - Gagina (1960), including Turov (1923) and Štegman (1936);

B - All published sources (up to Jumov 1990);

C - Our observations. All bird species recorded by us on the Svjatoj Nos isthmus and along the western shore of Čivyrkujskij Bay are included.

D - Sharrock' s (1974) categories of the breeding status, as recorded by us.

Note: Earlier authors often described their observations in general terms only, not giving exact localities. We included in this table only those records which were clearly related to the Svjatoj Nos isthmus and the western shore of Čivyrkujskij Bay.

A-C: 1 - confirmed breeding; 2 - summer observations, without confirmed breeding; 3 - only on migration; 4 - only in winter, 5 - vagrant.

Ecology of the Svjatoj Nos wetlands, Lake Baikal.
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COMMENTS ON THE DISTRIBUTION OF THE HOODED CRANE *GRUS MONACHA* IN BURYATIA

B.O. Jumov

Institute of Biology, Buryat Scientific Center, Siberian Department of the Russian Academy of Sciences, Sach' janovoj 6, SU-670042 Ulan-Ude, Buryatia, Russian Federation.

The Hooded Crane is a rare species in Buryatia. Most observations were made during migration and the wanderings of summer individuals. Summer and possibly breeding individuals were rarely observed in the Barguzin valley (Gagina 1960, Doržiev et al. 1985). Migrating birds were seen in Tugnuj valley (Vasiľčenko and Prokop' ev 1988), in the north-eastern corner of Baikal (Skrjabin and Filonov 1962), and in Orongoj valley, some 70 km west of Ulan-Ude (B.Š. Radnaev, pers. communication).

In August 1981, a flightless juvenile Hooded Crane was caught approximately 30-40 km west of Ulan-Ude, which confirms rare breeding of the Hooded Crane in that region (Doržiev et al. 1985).

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Ecology of the Svjatoj Nos wetlands, Lake Baikal.
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POPULATION STATUS AND FOOD OF THE WHITE-TAILED FISH EAGLE *HALIAEETUS ALBICILLA* (AVES: ACCIPITRIDAE) IN THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

J. Mlíkovský

Department of Evolutionary Biology, Czechoslovak Academy of Sciences,
Sekaninova 28, CS-128 00 Praha 2, Czechoslovakia.

Abstract: The breeding population of the White-tailed Fish Eagle in the Svjatoj Nos wetlands was estimated at 2-3 pairs. The diet of these birds consists mainly of avian prey (particularly ducks), which makes up 89% of the diet.

Key-words: Lake Baikal, Svjatoj Nos wetlands, *Haliaeetus albicilla*, population status, diet.

Introduction

The White-tailed Fish Eagle *Haliaeetus albicilla* (Linnaeus) belongs to the rare raptors in Buryatia (Kel'berg and Prokop' ev 1988). However, no research on the biology of this species in Buryatia has been conducted as yet. Below I have presented the results of an analysis of food remains of this eagle collected in the extensive Svjatoj Nos wetlands of NE Lake Baikal and comment on its population status in the region.

Acknowledgments: The study of the White-tailed Fish Eagle food was conducted in the frame of the 1991 Svjatoj Nos expedition. During the fieldwork I was assisted by Ludmila Samková (LS) and Petr Stýblo (PS). I thank them both.

Material and methods

Remains of prey and food pellets were collected below three nests of the White-tailed Fish Eagle in the Svjatoj Nos wetlands. In addition, isolated pellets were collected in a light taiga nearby nest "B". Collected bones and bone fragments were cleaned and identified using the comparative collection of avian skeletons in Praha (author' s collection). Minimum numbers of individuals were calculated according to standard methods (Grayson 1984). Svjatoj Nos wetlands are described in detail by Mlíkovský et al. (1992), their plant communities by Chytrý and Pešout (1992), fish fauna by Samek (1992), avifauna by Heyrovský et al. (1992), and mammalian fauna by Lípa and Reiter (1992).

Results

Population size

In summer 1991 we found 6 nests in the Svjatoj Nos wetlands, of which at least two were occupied by eagles (Fig. 1). A description of the nests is given below:

(A) Relatively small nest, approximately 14 m high on a live pine tree (*Pinus sylvestris*), deep in the marshes at Kulinoe. The nest was occupied in 1991 according to the local shepherd, but breeding success remained unknown. Prey remains were collected on 12 August (JM, PS).

(B) Very large nest, approximately 14 m high on a live pine tree (*Pinus sylvestris*) in light taiga in Kedrovka. Three young were observed sitting in the nest in late July 1991 (DH, PS), but I observed only two young eagles in the vicinity of this nest during August. Prey remains were collected on 9 August (JM, LS, PS).

(BB) Pellets, collected on 9 August in a live light taiga nearby nest B (JM, LS, PS).

(C) Very large nest, laying broken below a dead pine tree (*Pinus sylvestris*) at the border of former light taiga in Kedrovka. Prey remains were collected on 9 August (JM, LS, PS).

(D) Rather small nest, approximately 16 m high on a dead pine tree (*Pinus sylvestris*) in dead remains of taiga inside marshes NE of Kedrovka. No signs of breeding activities and no prey remains were found in late August (PS).

(E) Large nest, approximately 10 m high on a dead pine tree (*Pinus sylvestris*) in dead remains of taiga inside the marshes NE of Kedrovka. In late July, two adult eagles were observed near the nest and in late August feather remains were found in the nest (PS). Breeding was thus possible, though not confirmed. However, no prey remains were found in the nest in late August (PS).

(F) Nest in dead remains of taiga inside the marshes near the northernmost Barmašovoe Lake (JM). This nest was not visited by us.

The breeding population of the White-tailed Fish Eagles in the Svjatoj Nos wetlands can be thus estimated at at least 2-3 pairs.

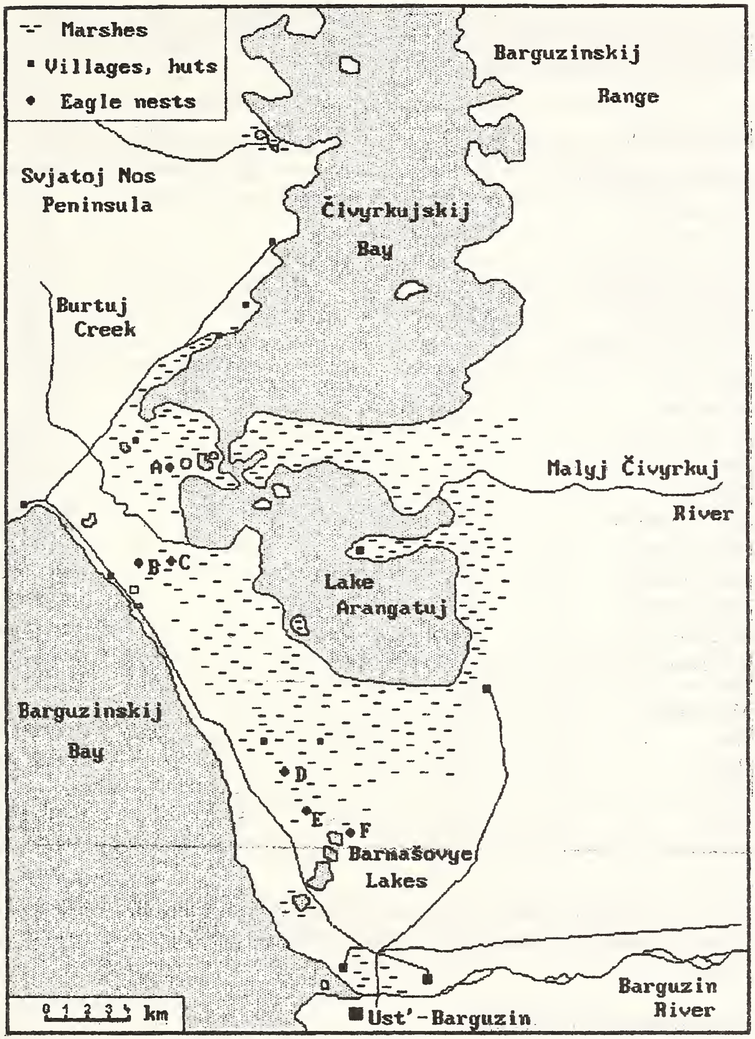

Fig. 1. Distribution of nests of the White-tailed Fish Eagle *Haliaeetus albicilla* in the Svjatoj Nos wetlands, Lake Baikal.

Diet

Overall, remains of 111 prey items of the White-tailed Fish Eagle, collected under three nests (A-C) and in light taiga nearby the nest B (BB)

Table 1. Food of the White-tailed Fish Eagle in the Svjatoj Nos wetlands, Lake Baikal. See text for sample descriptions.

Taxon/Sample	A	B	C	BB	Total
Ondatra zibethicus	-	-	3	2	5
Gavia arctica	-	-	1	-	1
Gavia stellata	-	-	2	-	2
Podiceps cristatus	-	1	-	1	2
Podiceps auritus	-	2	2	-	4
Ardea cinerea	-	1	-	-	1
Tadorna ferruginea	-	-	3	-	3
Anas spp.	11	22	28	1	62
Aythya spp.	-	6	8	-	14
Mergus serrator	-	-	1	-	1
Numenius arquata	-	-	1	-	1
Tringa sp.	-	-	1	-	1
Larus argentatus	-	2	-	-	2
Larus canus	-	-	-	1	1
Larus minutus	-	1	-	-	1
Sterna hirundo	-	1	-	-	1
Esox lucius	6	1	1	-	8
Carassius auratus	-	1	-	-	1
Mammalia	-	-	3	2	5
Aves	11	36	47	3	97
Pisces	6	2	1	-	9
Total	17	38	51	5	111

could be identified (Tab. 1). In two of these nests, the diet consisted almost exclusively of water birds, while in the nest A, fish were important as well.

Composition of prey remains

Overall, 873 bird bones were counted in the prey remains from the Svjatoj Nos wetlands (excluding vertebrae and phalanges, but phalanx I digiti majoris). The results (Tab. 2) show that mostly wing and shoulder bones remained preserved, while hindlimb bones were almost absent. A closer examination showed, however, that a variation exists in the latter proportion. A comparison of numbers of three main wing bones (humerus + ulna

+ carpometacarpus) with those of three main leg bones (femur + tibiotarsus + tarsometatarsus) revealed that leg bones made only 4% of these bones in nest B (n = 130), and 5% in nest A (n = 39), but 23% in nest C (n = 162). Total proportion of leg bones was 13%.

A study of bone breakage showed that some of the bones are usually preserved undamaged (e.g. coracoids and most of the wing bones), while others, such as skull, sternum or pelvis, are usually rather damaged.

Table 2. Composition of avian remains from the food of White-tailed Fish Eagles in the Svjatoj Nos wetlands. A-C = number of bones recovered under the nests A, B, and C, respectively; D = sum of values A-C; E = number of broken bones; F = proportion of broken bones [% of D].

Bone	A	B	C	D	E	F
Skull	1	12	22	35	35	100.0
Sternum	9	42	38	89	88	98.9
Pelvis	4	14	18	36	34	94.4
Coracoid	12	42	38	122	9	7.4
Scapula	12	38	60	110	98	89.1
Furcula	1	2	7	10	6	60.0
Humerus	14	50	55	119	9	7.6
Ulna	11	40	36	87	5	5.7
Radius	11	38	34	83	20	24.1
Carpometacarpus	12	35	34	81	3	3.7
Phalanx I dig. maj.	7	30	21	58	-	0.0
Femur	-	1	8	9	1	11.1
Tibiotarsus	1	2	17	20	4	20.0
Fibula	-	1	2	3	1	33.3
Tarsometatarsus	1	2	8	11	5	45.5
Total	96	349	428	873	317	36.3

Discussion

Population size

White-tailed Fish Eagles were apparently common in NE Baikal before the water level of the lake was raised in 1962 by the Irkutsk dam. In 1955, Gusev (1976) counted eight nests in the Čivyrkujskij Bay. In 1958-1961 Skrjabin and Filonov (1962) considered White-tailed Fish Eagles common breeders in the coastal region of NE Baikal, including the Svjatoj Nos wetlands. Since then the population size apparently decreased in the region. I have found only 2-3 breeding pairs in the Svjatoj Nos wetlands in 1991, and Anakin (1986) mentioned, that only one pair bred in the whole Barguzinskij reserve in the early 1980s.

Another question is, what is the carrying capacity of the Svjatoj Nos wetlands as regards the White-tailed Fish Eagles. Their area is approximately 300 km^2 (Mlíkovský et al. 1992). One pair (with young) can thus occupy approximately 100-150 km^2. This is somewhat less than in the Bauntovskaja basin in NE Buryatia (200 km^2, Popov 1987) and in the Lena basin in Yakutia (310 km^2, Labutin et al. 1988). It is thus possible that the Svjatoj Nos wetlands (without the Čivyrkujskij Bay) can be reasonably occupied by a maximum of three breeding pairs of the White-tailed Fish Eagles. The local sub-population of this eagle may thus well be near or even at its long-term maximum.

Kel'berg and Prokop' ev (1988) estimated the overall population of White-tailed Fish Eagles in Buryatia at a maximum of 20 breeding pairs. The population will be higher, however, because Popov (1987) discovered that some 25-30 pairs breed in the Bauntovskaja basin in NE Buryatia. This sub-population was unknown to Kel'berg and Prokop' ev (1988).

Diet

Fish has been traditionally regarded to be the main food of the White-tailed Fish Eagles (Fischer 1970) and this opinion has also been repeated for the White-tailed Fish Eagles in Buryatia (Skrjabin 1975, Kel'berg and Prokop' ev 1988).

Primary data on the diet of the White-tailed Fish Eagle in Buryatia are very limited. Skrjabin and Filonov (1962) mentioned that White-tailed Fish Eagles fed primarily upon fish in the Svjatoj Nos wetlands, but that carrion and birds (mainly ducks and gulls) were also of importance. Gusev (1976) wrote that *Rutilus rutilus* and *Perca fluviatilis* were the main food of the White-tailed Fish Eagle in the Čivyrkujskij Bay, while *Thymallus arcticus* in the Barguzinskij Bay. Popov (1987) reported that White-tailed Fish Eagles preyed mainly upon fish (mostly *Carassius auratus*), ducks, and muskrats in the Bauntovskaja basin in NE Buryatia.

My results presented above show that White-tailed Fish Eagles generally feed mostly upon birds in the Svjatoj Nos wetlands, although the proportion of fish in one of the nests was not negligible.

In Yakutia, Labutin et al. (1965, 1988) found that mammals (*Citellus undulatus* and *Arvicola terrestris*, respectively), were the dominant prey of the White-tailed Fish Eagles in two localities, while birds (mainly ducks) were dominant in two other localities.

Table 3. Comparison of diet of the White-tailed Fish Eagle in Siberia: in the Svjatoj Nos wetlands (this paper), and at the lower Lena river in Yakutia (Labutin et al. 1988). All data refer to prey remains found in and/or under nests of the eagles.

Genus	Sv. Nos		Lena	
	n	%	n	%
Lepus	-	-	16	4.8
Ondatra	3	2.8	60	18.2
Arvicola	-	-	3	0.9
Microtus	-	-	1	0.3
Gavia	3	2.8	6	1.8
Podiceps	5	4.7	2	0.6
Ardea	1	0.9	-	-
Anser	-	-	4	1.2
Tadorna	3	2.8	-	-
Anas	61	57.5	87	26.4
Aythya	14	13.2	18	5.5
Melanitta	-	-	4	1.2
Mergus	1	0.9	4	1.2
Tetrao	-	-	3	0.9
Lagopus	-	-	1	0.3
Numenius	1	0.9	-	-
Tringa	1	0.9	1	0.3
Larus	3	2.8	5	1.5
Sterna	1	0.9	1	0.3
Strix	-	-	1	0.3
Corvus	-	-	3	0.9
Perisoreus	-	-	7	2.1
Acipenser	-	-	2	0.6
Esox	8	7.5	69	20.9
Carassius	1	0.9	24	7.3
Perca	-	-	6	1.8
Lota	-	-	2	0.6
Mammalia	3	2.8	80	24.2
Aves	94	88.3	147	44.5
Pisces	9	8.4	103	31.2
Total	106	99.5	330	99.9

In Primorye, Labzjuk (1975) observed that the diet of White-tailed Sea Eagles changed seasonally with the availability of prey. Fish were generally the most common prey, but the proportion of ducks increased during the hunting season, when eagles collected dead or wounded birds. Unfortunately, no quantified list of prey species was presented by Labzjuk (1975).

To summarize this scarce information on the diet of the White-tailed Fish Eagle in Siberia (see Tab. 3 for quantified data), it can be concluded that the species is an opportunistic predator which takes all available prey, including carcasses. This agrees well with the data from Kazakhstan (Gračev 1964, 1976) and Europe (Fischer 1970, Cramp and Simmons 1980). White-tailed Fish Eagles of the Svjatoj Nos wetlands are special in taking an exceptionally large proportion of avian prey.

Composition of prey remains

The marked differences in numbers of bones preserved are apparently caused by the style in which eagles handle and eat their prey. From the relative numbers of bones and their breakage it can be inferred that White-tailed Fish Eagles usually swallow legs, eat most of the body in pieces (sternum and pelvis are mostly bitten), and only pick meat from the humerus, otherwise leaving the wings unswallowed.

Summary

The population of the White-tailed Fish Eagle has declined in the area of the Svjatoj Nos wetlands and elsewhere in NE Baikal over the last 30 years. The reasons for this are unknown because of the absence of appropriate observations.

The diet of the White-tailed Fish Eagles in the Svjatoj Nos wetlands consists mainly of water birds, the proportion of fish and mammals is negligible.

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WEIGHTS AND MEASUREMENTS OF BIRDS FROM THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

P. Stýblo[1], J. Mlíkovský[2]

[1]Nádražní 314, CS-262 31 Milín, Czechoslovakia.
[2]Department of Evolutionary Biology, Czechoslovak Academy of Sciences, Sekaninova 28, CS-128 00 Praha 2, Czechoslovakia.

Abstract: Weights and measurements of 186 individuals of birds of 32 species caught in the Svjatoj Nos wetlands are presented. Sex and age differences in body dimensions were tested for *Emberiza aureola*.

Key-words: Lake Baikal, Svjatoj Nos wetlands, Aves, biometry.

Introduction

Statistically evaluated weights and measurements of Siberian birds are rarely found in literature, although general data are often reported in taxonomical reviews of Siberian birds. No exact data on weights or measurements of birds from NE Baikal were published till now, although we were told that the ornithologist N.G. Skrjabin from Irkutsk measured birds in the area in the 1980s (E.D. Ovdin, pers. communication). His results have not been published as yet.

Acknowledgments: The data presented below were obtained during the Svjatoj Nos 1991 expedition. David Heyrovský, Tomáš Koutný, Emanuel Mallia and Joseph Mangion assisted in mistnetting and measuring the birds. We are obliged to all of them.

Material and methods

Birds were mistnetted and/or caught by other means during 8 July - 28 August 1991 in different points of the Svjatoj Nos wetlands. The area is described by Mlíkovský et al. (1992) and its avifauna by Heyrovský et al. (1992).

The birds were identified using the keys by Flint et al. (1968), Vinogradova et al.(1976), Ivanov and Štegman (1978), and Sonobe and Robinson (1982). The wing chord was measured (slightly flattened) to the nearest 1 mm, weights to the nearest gram, or 0.5 g in the smallest passerines. The following data were recorded: (A) sex, (B) age, (C) date, (D) body mass, (E) wing length, (F) tail length, (G) bill length (from frontal feathers), and (H) tarsus length (Appendix 1). For some birds, the wing formula was measured according to Mlíkovský (1978) as follows: distance between tip of the outermost primary and the longest covers; distances between tip of further seven primaries and the tip of the longest primary; and distance between the tip of the outermost secondary and the tip of the longest primary (Appendix 2). This standard methodology was introduced in Europe in the frame of the Action Baltic.

Standard statistical tests were used in testing the sex and age differences in weight and measurements of Yellow-breasted Buntings *Emberiza aureola* Pallas (Sachs 1974).

Results and Discussion

The weights and measurements obtained for the birds of the Svjatoj Nos wetlands generally agreed with those given for the species by Ivanov and Štegman (1978) and Vinogradova et al.(1976). Only in a few cases (1 *Jynx torquilla*, 1 *Phylloscopus inornatus*, 4 *Emberiza aureola*) wing lengths were obtained by 1-3 mm shorter than given by Vinogradova et al. (1976). This could be caused by a different style of measurement, because Vinogradova et al. (1976) used maximum stretching of wings, which results in larger data than the method used by ourselves. Alternatively, the differences may reflect geographical variability of the birds, which has not yet been described sufficiently.

This implies that future work in the Baikal area should take into account the problems of the subspecific divisioning of Siberian birds. This is supported by our observation that individuals of the Pallas' s Reed Bunting *Emberiza pallasi* (Cabanis) differed in size and color details from the subspecies, which should occur in the area according to the revision of the species by Loskot (1986), although the measurements felt in the frame of measurements given for the species as a whole (Vinogradova et al. 1976, Loskot 1986).

The Yellow-breasted Bunting *Emberiza aureola* was abundant in the Svjatoj Nos wetlands. Overall, 53 individuals were measured (Tab. 1). Testing the results for differences between sex and age classes by t-test (Sachs 1974: 214) lead to the following conclusions (Tab. 2). Males were significantly larger than females and juveniles (unsexed) in all measurements taken (body mass, wing length, and tail length). On the other hand,

Table 1. Biometry of the Yellow-breasted Buntings *Emberiza aureola* from the Svjatoj Nos wetlands. Almost all of the adults were caught during July, while almost all of the juveniles in August. All weights and measurements are in gram and mm, respectively. CV is in %. M = males, F = females. See Appendices 1 and 2 for primary data.

	Mean	SD	CV	Range	n
Weight					
ad M	19.6	1.83	9.3	15-23	14
ad F	18.1	2.17	12.0	14-22.5	17
juv	17.9	2.74	15.3	14-22	21
Wing length					
ad M	75.8	2.25	2.97	71-79	17
ad F	71.1	1.80	2.53	66-73	17
juv	71.1	3.04	4.28	63-74	23
Tail length					
ad M	58.1	2.49	4.28	53-61	17
ad F	54.4	2.55	4.69	50-59	17
juv	54.0	2.41	4.46	50-59	22
Wing formula					
ad M		-; 1, 0, 0, 1, 7, 11, 14; 19			6
ad F		-; 1, 0, 0, 2, 7, 10, 12; 18			7

Table 2. Comparison of mean body mass, wing length, and tail length between adult males (M), adult females (F) and juveniles (unsexed, J). T-test values and significances are given. * = $p < 0.05$, ** $p < 0.01$, *** = $p < 0.001$. See Table 1 for primary statistics and Appendix 1 for primary data.

Character	M-F	M-J	F-J
weight	2.088 *	2.201 *	0.716
wing length	6.725***	5.619***	0.000
tail length	4.280***	5.171***	0.497

no significant differences were found between females and juveniles. This indicates that sexual size dimorphism is probably achieved by enhanced growth of the males after the juvenile period in Yellow-breasted Buntings, but more information can only be got after juveniles can be sexed.

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Appendix 1.

Weights and measurements of birds from the Svjatoj Nos wetlands. A = sex (M, male; F, female), B = age, C = date (day/month), D = body mass, E = wing length, F = tail length, G = bill length, H = tarsus length. Measurements are in grams and mm, respectively. See Appendix 2 for the wing formulae of these birds.

Nr.	Species	A	B	C	D	E	F	G	H
001	*Porzana pusilla*	-	ad	25/8	42	94	42	14	30
002	*Gallinago stenura*	-		28/7	-	131	46	-	-
003	dtto	-		23/8	95	128	48	59	35
004	*Limnodromus semipalmatus*	-	juv	08/8	142	172	63	-	-
005	dtto	-	ad	08/8	160	178	62	-	-
006	*Tringa stagnatilis*	-	juv	08/8	52	127	56	-	-
007	dtto	-	juv	08/8	54	132	52	-	-
008	dtto	-	juv	08/8	49	128	56	-	-
009	*Tringa glareola*	-	juv	08/8	49	118	48	-	-
010	*Jynx torquilla*	-		25/8	26	76	61	12	18
011	*Hirundo rustica*	F	ad	26/7	15	119	85	7	11
012	dtto	-		26/7	16	116	-	6	12
013	dtto	-		26/7	16	117	99	7	11
014	*Anthus trivialis*	-		10/7	19	81	59	-	21
015	dtto	-	juv	18/8	-	87	63	-	-
016	dtto	-	juv	18/8	-	83	61	-	-
017	dtto	-	juv	18/8	19	80	57	-	-
018	dtto	-	juv	19/8	18	81	64	-	-
019	dtto	-	juv	19/8	19	82	61	-	-
020	dtto	-	juv?	19/8	23	87	61	-	-
021	dtto	-		20/8	20	80	60	-	-
022	dtto	-	juv	20/8	19	82	60	-	-
023	dtto	-		20/8	21	85	61	-	-
024	dtto	-	juv	23/8	19	83	60	-	-
025	*Motacilla flava*	-	juv	25/8	16	80	74	-	-
026	*Motacilla citreola*	-	juv	18/8	-	80	75	12	-
027	dtto	-	juv	18/8	15	81	72	-	-
028	dtto	F	ad	23/8	18	78	77	-	22

029	dtto	- juv	24/8	20	88	77	-	-
030	dtto	- juv	24/8	17	80	67	-	-
031	dtto	- juv	24/8	21	86	80	-	-
032	dtto	- juv	25/8	15	78	67	-	-
033	dtto	- juv	25/8	19	80	71	-	-
034	dtto	- juv	25/8	18	77	65	-	-
035	dtto	- juv	25/8	18	81	70	-	-
036	dtto	- juv	26/8	18	87	78	-	-
037	dtto	- juv	26/8	16	80	71	-	-
038	*Motacilla cinerea*	M ad	28/8	15	78	92	-	-
039	*Motacilla alba*	- juv	5/7	17	57	-	-	-
040	dtto	M ad	8/7	25	91	98	14	25
041	dtto	M ad	8/7	23	90	97	12	23
042	dtto	- juv	8/7	18	67	-	10	23
043	dtto	F ad	8/7	21	86	-	12	23
044	dtto	- juv	14/7	-	85	86	12	25
045	dtto	- ad	18/8	-	87	93	11	-
046	dtto	- ad	18/8	-	92	93	11	-
047	dtto	- ad	19/8	-	93	93	11	-
048	dtto	- juv	20/8	25	92	96	-	-
049	dtto	- juv	23/8	20	87	90	-	-
050	dtto	- juv	27/8	22	86	80	-	-
051	dtto	- juv	27/8	20	89	86	-	-
052	*Luscinia calliope*	F ad	9/7	20	74	59	12	28
053	dtto	F ad	9/7	24	71	59	12	27
054	dtto	M ad	10/7	21	75	63	-	-
055	dtto	F ad	03/8	21	70	58	-	-
056	*Luscinia cyane*	- juv	02/8	16	69	45	-	-
057	*Tarsiger cyanurus*	- juv	27/8	17	72	43	-	-
058	dtto	- juv	28/8	15	70	42	-	-
059	dtto	- juv	28/8	14	69	41	-	-
060	dtto	- juv	28/8	18	72	45	-	-
061	*Phoenicurus auroreus*	-	23/8	-	75	55	9	20
062	*Saxicola torquata*	- juv	18/8	-	69	52	12	-
063	*Locustella certhiola*	M? ad	8/7	16	62	51	12	22
064	dtto	-	8/7	15	66	52	11	21
065	dtto	-	8/7	16	61	48	12	21
066	dtto	- juv	22/8	15	62	48	-	-

067	dtto	-	ad	23/8	16	65	50	-	-
068	dtto	-	juv	25/8	13	62	52	-	-
069	dtto	-	juv	27/8	10	57	49	-	-
070	dtto	-	juv	27/8	11	56	45	-	-
071	*Acrocephalus aedon*	-		18/8	22	81	83	-	-
072	*Phylloscopus borealis*	-		27/8	-	67	46	-	-
073	dtto	-	ad	28/8	10	63	44	-	-
074	dtto	-	ad	28/8	9	65	40	-	-
075	dtto	-	ad	28/8	11	69	47	-	-
076	dtto	-	ad	28/8	10	66	44	-	-
077	*Phylloscopus inornatus*	M?	ad	8/7	6	57	41	-	18
078	dtto	-		23/8	-	51	38	-	-
079	dtto	-	juv	25/8	6	53	38	-	-
080	dtto	-	juv	25/8	7	53	34	-	-
081	dtto	-	ad	27/8	5	50	31	-	-
082	*Phylloscopus fuscatus*	-		10/7	9.5	65	57	9	22
083	dtto	-		10/7	8.5	60	53	8	23
084	dtto	-		10/7	9	61	53	9	22
085	dtto	-		10/7	9	63	56	8	23
086	dtto	M	ad	13/7	-	56	52	11	22
087	dtto	-		14/7	-	60	54	11	23
088	dtto	M	ad	14/7	-	57	54	9	22
089	dtto	F	ad	09/8	9.5	54	45	-	-
090	*Muscicapa sibirica*	-		19/7	14	81	53	13	13
091	*Ficedula parva*	-	juv	18/8	10	66	48	-	-
092	dtto	-	juv	25/8	9	65	47	-	-
093	*Parus ater*	-		26/7	9	61	45	8	16
094	*Sitta europaea*	-		19/8	-	77	42	13	-
095	dtto	-		22/8	-	78	44	-	-
096	dtto	-		25/8	17	77	41	-	-
097	*Lanius cristatus*	F	ad	15/8	31	85	81	-	-
098	dtto	-	juv	18/8	29	84	83	-	-
099	dtto	-	juv	19/8	31	87	86	-	-
100	dtto	F	ad	19/8	-	86	86	-	-
101	dtto	-	juv	22/8	28	83	86	-	-
102	dtto	-	ad	22/8	25	83	85	-	-
103	dtto	-	juv	22/8	-	85	85	-	-
104	dtto	-	juv	22/8	30	83	85	-	-

105	dtto	-	juv	22/8	26	83	83	-	-
106	dtto	-	ad	23/8	29	87	87	-	-
107	dtto	-	juv	25/8	30	81	80	-	-
108	dtto	-	juv	27/8	28	82	85	-	-
109	*Nucifraga caryocatactes*	-	juv	28/8	152	171	119	-	-
110	*Corvus corax*	-	juv	20/8	-	413	252	-	-
111	*Carpodacus erythrinus*	-		19/8	21	81	56	-	-
112	*Emberiza rutila*	-		19/7	20	70	52	10	20
113	dtto	-		19/7	20	70	-	9	20
114	*Emberiza aureola*	M	ad	8/7	19.5	78	59	12	20
115	dtto	M	ad	8/7	19.5	75	59	11	20
116	dtto	F	ad	8/7	21	73	55	12	20
117	dtto	M	ad	8/7	20	77	60	12	20
118	dtto	F	ad	8/7	20	71	56	10	21
119	dtto	M	ad	8/7	21	78	59	11	20
120	dtto (= Nr. 118)	F	ad	9/7	17.5	-	-	-	-
121	dtto	M	ad	9/7	20.5	77	61	11	21
122	dtto	M	ad	9/7	20.5	79	61	12	20
123	dtto	F	ad	9/7	18	71	56	10	21
124	dtto	F	ad	9/7	19.5	72	55	10	20
125	dtto	F	ad	9/7	17	73	57	10	20
126	dtto	F	ad	9/7	17	73	59	11	19
127	dtto	M	ad	9/7	20.5	78	61	11	20
128	dtto	F	ad	10/7	18	66	52	-	-
129	dtto	M	ad	10/7	18	75	54	-	-
130	dtto	M	ad	10/7	23	76	57	-	-
131	dtto	M	ad	10/7	-	75	59	-	-
132	dtto	F	ad	10/7	15.5	72	54	-	-
133	dtto	M	ad	11/7	18	74	61	-	-
134	dtto	M	ad	11/7	19	71	53	-	-
135	dtto	F	ad	11/7	20	71	52	-	-
136	dtto	F	ad	14/7	-	69	52	-	-
137	dtto	M	ad	14/7	-	76	57	-	-
138	dtto	M	ad	14/7	-	77	57	11	20
139	dtto	-	juv	14/7	-	63	52	9	21
140	dtto	F	ad	15/7	22.5	70	50	-	-
141	dtto	M	ad	16/7	20	77	57	11	19
142	dtto	F	ad	16/7	19.5	72	56	11	20

143	dtto	M ad	26/7	20.5	73	57	12	21
144	dtto	F ad	31/7	17.5	70	50	-	-
145	dtto	M ad	02/8	15	72	55	-	-
146	dtto	F ad	19/8	14	72	56	-	-
147	dtto	F ad	19/8	16	71	57	-	-
148	dtto	- juv	19/8	18	74	53	-	-
149	dtto	F ad	21/8	16	73	55	-	-
150	dtto	- juv	22/8	15	68	56	-	-
151	dtto	- juv	23/8	14	72	54	-	-
152	dtto	- juv	23/8	15	71	57	-	-
153	dtto	- juv	23/8	20	69	52	-	-
154	dtto	- juv	23/8	17	70	58	-	-
155	dtto	- juv	23/8	-	72	59	-	-
156	dtto	-	23/8	22	73	56	-	-
157	dtto	F ad	24/8	19	70	53	-	-
158	dtto	- juv	24/8	15	65	56	-	-
159	dtto	- juv	25/8	15	72	57	-	-
160	dtto	- juv	25/8	14	71	52	-	-
161	dtto	- juv	26/8	18	73	-	-	-
162	dtto	- juv	27/8	19	69	55	-	-
163	dtto	-	27/8	20	74	55	-	-
164	dtto	- juv	27/8	21	77	55	-	-
165	dtto	- juv	27/8	16	70	53	-	-
166	dtto	- juv	27/8	18	74	51	-	-
167	dtto	- juv	27/8	18	72	53	-	-
168	dtto	- juv	27/8	19	73	53	-	-
169	dtto	- juv	27/8	22	71	51	-	-
170	dtto	- juv	27/8	22	75	55	-	-
171	dtto	- juv	27/8	23	72	53	-	-
172	dtto	- juv	27/8	20	72	53	-	-
173	dtto	- juv	28/8	17	70	50	-	-
174	*Emberiza pallasi*	- juv	23/8	13	61	54	-	-
175	dtto	F ad	23/8	12	64	58	-	-
176	dtto	M ad	23/8	-	69	63	-	-
177	dtto	-	24/8	11	67	54	-	-
178	dtto	- juv	25/8	11	69	58	-	-
179	dtto	- juv	25/8	11	69	58	-	-
180	dtto	- juv	25/8	13	68	58	-	-

181	dtto	-	juv	25/8	14	67	62	-	-
182	dtto	-	juv	26/8	12	67	58	-	-
183	dtto	-	juv	27/8	14	65	61	-	-
184	dtto	-	juv	27/8	14	69	61	-	-
185	dtto	M	ad	27/8	15	71	59	-	-
186	dtto	M	ad	27/8	13	66	58	-	-
187	dtto	-	juv	28/8	15	71	57	-	-

Appendix 2.

Wing formulae of birds from the Svjatoj Nos wetlands. Notation after Mlíkovský (1978). See text for explanation. All measurements are in mm. The numbers in the first column correspond to them in the Appendix 1.

Nr.	Species	Wing formula
001	*Porzana pusilla*	-;11, 0, 0, 2, 5, 8, 12; 26
002	*Gallinago stenura*	13; 0, 0, 2, 8, 16, 31, 37; 56
003	dtto	-; 0, 0, 2, 7, 13, 18, 26; 47
004	*Limnodromus semipalmatus*	0, 2, 10,21,32, 44, 55, 63; 89
005	dtto	0, 0, 6, 17,29, 33, 43, 53; 90
006	*Tringa stagnatilis*	0, 2, 7, 15,24, 33, 39, 49; 61
007	dtto	0, 2, 7, 14,22, 31, 40, 48; 64
008	dtto	0, 0, 5, 14,23, 32, 38, 47; 60
009	*Tringa glareola*	0, 1, 4, 13,21, 29, 36, 42; 57
010	*Jynx torquilla*	-; 7, 2, 0, 1, 4, 8, 10; 21
015	*Anthus trivialis*	-; 0, 0, 0, 2, 10, 15, 18; 25
016	dtto	-; 0, 0, 0, 2, 10, 14, 17; 22
017	dtto	-; 0, 0, 1, 2, 11, 15, 19; 23
018	dtto	-; 0, 0, 0, 1, 9, 13, 16; 26
019	dtto	-; 0, 0, 1, 1, 12, 18, 20; 23
020	dtto	-; 0, 0, 1, 2, 11, 17, 20; 25
021	dtto	-; 0, 0, 0, 2, 12, 15, 18; 25
022	dtto	-; 1, 0, 0, 2, 13, 16, 19; 24
023	dtto	-; 1, 0, 0, 1, 9, 13, 15; 20
024	dtto	-; 0, 0, 0, 2, 10, 13, 17; 22

025 *Motacilla flava*	-; 0, 0, 0, 4, 11, 16, 19; 25
026 *Motacilla citreola*	-; 3, 1, 0, 2, 8, 12, 16; 26
027 dtto	-; 0, 0, 3, 6, 13, 18, 20; 27
028 dtto	-; 1, 0, 0, 2, 10, 15, 17; 25
029 dtto	-; 1, 0, 0, 3, 11, 16, 19; 25
030 dtto	-; 0, 0, 1, 5, 12, 16, 18; 23
031 dtto	-; 1, 0, 1, 3, 11, 16, 19; 24
032 dtto	-; 0, 0, 1, 6, 13, 16, 19; 24
033 dtto	-; 0, 0, 0, 4, 12, 17, 19; 25
034 dtto	-; 0, 0, 0, 4, 11, 16, 19; 22
035 dtto	-; 0, 0, 0, 4, 12, 16, 19; 24
036 dtto	-; 0, 0, 0, 4, 12, 17, 20; 25
037 dtto	-; 1, 0, 0, 4, 11, 16, 19; 24
038 *Motacilla cinerea*	-; 0, 0, 0, 6, 12, 17, 20; 27
044 *Motacilla alba*	-; 1, 0, 0, 3, 12, 18, 21; 23
045 dtto	-; 2, 0, 0, 2, 12, 16, 20; 30
046 dtto	-; 0, 0, 1, 5, 15, 20, 23; 32
047 dtto	-; 0, 0, 1, 5, 15, 21, 25; 31
048 dtto	-; 0, 0, 0, 1, 11, 17, 22; 29
049 dtto	-; 0, 0, 1, 4, 13, 19, 22; 30
050 dtto	-; 0, 0, 0, 3, 13, 18, 22; 26
051 dtto	-; 0, 0, 0, 3, 13, 17, 21; 27
054 *Luscinia calliope*	8; 8, 1, 0, 0, 3, 6, 8; 16
055 dtto	9; 6, 0, 0, 2, 3, 5, 7; 12
056 *Luscinia cyane*	2; 6, 1, 0, 1, 5, 9, 10; 15
058 *Tarsiger cyanurus*	6; 7, 1, 0, 1, 5, 9, 11; 15
059 dtto	4; 7, 1, 0, 1, 6, 8, 10; 15
060 dtto	4;10, 1, 0, 2, 6, 10, 12; 16
061 *Phoenicurus auroreus*	2; 8, 1, 0, 2, 8, 12, 15; 21
062 *Saxicola torquata*	5; 6, 1, 0, 0, 1, 4, 7; 16
066 *Locustella certhiola*	1; 3, 0, 2, 4, 6, 8, 9; 15
067 dtto	2; 4, 0, 2, 5, 8, 9, 10; 16
068 dtto	1; 4, 0, 2, 5, 8, 10, 12; 16
069 dtto	0; 2, 0, 1, 3, 6, 9, 10; 17
070 dtto	1; 2, 0, 2, 3, 5, 7, 7; 13
071 *Acrocephalus aedon*	7; 7, 0, 1, 2, 5, 8, 10; 19
072 *Phylloscopus borealis*	0; 5, 0, 0, 1, 5, 9, 11; 16
073 dtto	2; 5, 0, 0, 2, 7, 10, 12; 15

074 dtto	1; 5, 0, 0, 2, 7, 10, 12; 16
075 dtto	1; 5, 0, 0, 2, 7, 10, 12; 17
076 dtto	-; 5, 0, 0, 2, 7, 11, 13; 17
078 *Phylloscopus inornatus*	6; 4, 0, 0, 0, 2, 4, 5; 10
079 dtto	5; 6, 1, 0, 0, 1, 4, 5; 10
080 dtto	5; 5, 0, 0, 0, 2, 5, 7; 11
081 dtto	4; 5, 0, 0, 1, 2, 4, 6; 10
086 *Phylloscopus fuscatus*	11; 8, 1, 0, 0, 2, 4, 5; 10
087 dtto	10; 10, 2, 0, 0, x, x, x; 11
088 dtto	12; 9, 2, 0, 0, 2, 4, 6; 9
089 dtto	10; 6, 0, 0, 0, 1, 2, 4; 9
091 *Ficedula parva*	5; 5, 0, 1, 2, 5, 8, 11; 15
092 dtto	6; 6, 0, 0, 1, 4, 9, 11; 15
094 *Sitta europaea*	3; 7, 0, 0, 0, 3, 10, 14; 19
095 dtto	4; 7, 0, 0, 0, 2, 9, 14; 21
096 dtto	3; 6, 0, 0, 0, 3, 11, 15; 18
097 *Lanius cristatus*	7; 9, 0, 0, 3, 8, 12, 15; 20
098 dtto	8; 10, 0, 0, 1, 5, 9, 12; 21
099 dtto	9; 9, 0, 0, 2, 7, 11, 14; 21
100 dtto	8; 10, 1, 0, 5, 11, 14, 16; 21
101 dtto	11; 8, 0, 0, 2, 7, 10, 13; 21
102 dtto	8; 9, 1, 0, 1, 7, 11, 14; 20
103 dtto	9; 8, 0, 0, 2, 8, 15, 18; 25
104 dtto	10; 9, 0, 0, 1, 8, 11, 14; 21
105 dtto	7; 8, 0, 0, 2, 7, 11, 14; 16
106 dtto	9; 9, 0, 0, 4,11, 15, 18; 27
107 dtto	9; 8, 0, 0, 1, 6, 10, 12; 19
108 dtto	7; 9, 0, 0, 1, 6, 10, 13; 22
109 *Nucifraga caryocatactes*	23; 20, 5, 0, 0, 3, 13, 23; 37
110 *Corvus corax*	109; 26, 0, 0, 9, 2,93,119;170
111 *Carpodacus erythrinus*	-; 1, 0, 0, 2, 8, 13, 15; 25
128 *Emberiza aureola*	-; 0, 0, 0, 2, x, 10, 12; 18
129 dtto	-; 2, 0, 0, 1, 7, 10, 12; 20
130 dtto	-; 0, 0, 1, 2, 8, 14, 16; 18
132 dtto	-; 0, 0, 1, 2, 7, 10, 11; 15
133 dtto	-; 0, 0, 0, 1, 8, 11, 14; 18
134 dtto	-; 1, 0, 0, 1, 7, 11, 13; 19
135 dtto	-; 1, 0, 0, 1, 8, 10, 10; 19

138 dtto	-; 1, 0, 0, 1, x, 11, 15; 23
139 dtto	-; 2, 0, 0, 1, 7, 9, x; 16
145 dtto	-; 1, 0, 1, 2, 7, 11, 13; 17
146 dtto	-; 2, 0, 0, 2, 7, 10, 13; 17
147 dtto	-; 0, 0, 1, x, x, x, x; 19
148 dtto	-; 2, 0, 0, 1, 5, 9, 11; 19
149 dtto	-; 3, 1, 0, 2, 7, 10, 13; 18
150 dtto	-; 2, 0, 0, 2, 6, 9, 11; 18
151 dtto	-; 2, 0, 0, 2, 7, 11, 14; 16
152 dtto	-; 2, 0, 0, 2, 7, 11, 14; 17
153 dtto	-; 2, 0, 1, 2, 7, 10, 12; 18
154 dtto	-; 1, 0, 0, 2, 6, 9, 12; 16
155 dtto	-; 2, 0, 0, 0, 7, 10, 12; 19
156 dtto	-; 1, 0, 0, 1, 7, 10, 12; 19
157 dtto	-; 1, 0, 1, 3, 7, 10, 12; 17
158 dtto	-; 1, 0, 0, 2, 7, 10, 12; 16
159 dtto	-; 0, 0, 0, 1, 6, 10, 13; 20
160 dtto	-; 3, 0, 0, 1, 6, 9, 11; 16
161 dtto	-; 1, 0, 0, 2, 7, 10, 11; 17
162 dtto	-; 2, 0, 0, 0, 5, 8, 11; 17
163 dtto	-; 2, 0, 0, 1, 7, 10, 13; 18
164 dtto	-; 2, 0, 0, 2, 8, 12, 13; 19
165 dtto	-; 2, 0, 1, 2, 7, 10, 12; 16
166 dtto	-; 2, 0, 0, 2, 6, 10, 12; 18
167 dtto	-; 1, 0, 0, 2, 6, 10, 12; 18
168 dtto	-; 1, 0, 0, 1, 5, 8, 10; 18
169 dtto	-; 1, 0, 0, 1, 6, 9, 11; 16
170 dtto	-; 1, 0, 0, 3, 7, 11, 13; 20
171 dtto	-; 2, 0, 0, 1, 6, 10, 12; 17
172 dtto	-; 1, 0, 0, 2, 8, 11, 13; 17
173 dtto	-; 2, 0, 0, 1, 6, 10, 12; 16
174 *Emberiza pallasi*	-; 2, 0, 0, 0, 0, 3, 7; 12
177 dtto	-; 2, 1, 0, 1, 5, 8, 10; 16
178 dtto	-; 1, 0, 0, 1, 4, 9, 11; 16
179 dtto	-; 2, 0, 0, 0, 5, 9, 11; 13
180 dtto	-; 2, 0, 0, 2, 5, 8, 11; 15
181 dtto	-; 2, 0, 0, 0, 4, 7, 10; 12
182 dtto	-; 3, 0, 0, 0, 1, 3, 7; 13

183 dtto	-; 3, 0, 0, 0, 2, 5, 7; 12
184 dtto	-; 2, 0, 0, 0, 1, 5, 8; 14
187 dtto	-; 1, 0, 0, 2, 6, 11, 14; 17

OTHER VERTEBRATES

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MAMMALS OF THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

M. Lípa[1] and A. Reiter[2]

[1]Brigádnická 710/2, CS-363 01 Ostrov, Czechoslovakia.
[2]Havlíčkova 20, CS-798 58 Čechy pod Kosířem, Czechoslovakia.

Abstract: 24 species of wild mammals (and three species of feral mammals) were registered in the Svjatoj Nos isthmus, including *Eptesicus nilssoni* which is new to the region. The list of mammals known from the Svjatoj Nos isthmus (26 wild species) is first presented.

Densities of micromammals were found to be generally low; only *Clethrionomys rutilus*, *Ondatra zibethicus*, *Microtus oeconomus*, and *Apodemus peninsulae* were common locally.

Key-words: Lake Baikal, Svjatoj Nos wetlands, mammals, distribution, communities.

Introduction

Mammaliological research in the NE Baikal has been exceedingly rare. The first special faunistic observations were made only in 1914-1915 in the Barguzinskij Range by an expedition headed by G.G. Doppeľmair (1926). In 1922-1923, S.S. Turov (1924, 1936) investigated the area. Following the foundation of the Barguzinskij reserve in 1916, mammaliological research started to be more lively, but focused primarily on game animals (e.g. Novikov 1938), while regular faunistic research started much later (Martynov et al. 1960, Filonov 1962). Later, mammals of the Uškan' i islands and the islands in the Čivyrkujskij Bay were investigated (Litvinov and Moložnikov 1969, Litvinov 1972, 1982, Matvejčuk 1990).

The Svjatoj Nos wetlands were almost entirely omitted by mammaliologists. The first brief research was done here by Turov (1924, 1936) in 1922-1923. Moložnikov (1970, 1974) studied the occurrence of large mammals in the Svjatoj Nos isthmus. Jumov et al. (1989, Jumov 1990) briefly visited the area in 1988. No list of mammals of the Svjatoj Nos wetlands has been published thus far.

The geographically nearest wetlands can be found in the Barguzin valley. Their mammals were studied in detail in 1974-1976 by Ljamkin (1977).

General monographs on the mammals of the Baikal region were presented by Švecov (1977) and Švecov et al. (1984).

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Material and methods

Mammals were studied in the Svjatoj Nos isthmus between 7-29 July by Antonín Reiter (AR) and between 29 July - 30 August by Martin Lípa (ML). Large or conspicuous mammals were observed directly. Micromammals were caught in snap-traps and live-traps. Bats were mistnetted. In addition, owl pellets were analyzed for the presence of micromammals.

Snap-traps were mostly set in quadrates of 11x11 points (Šťastný et al. 1989). The distance between points was 10 m. At each point, two snap-traps were located at a distance of 2 m from each other. Snap-traps were baited with wick pieces soaked with fat and browned wheat flour. Overall, 242 snap-traps were set per quadrate.

During the expedition, six quadrates were set, with the following characteristics:

(Q1) 7-11 July. Sandy dunes on the Barguzinskij Bay shore, near the base camp in Kedrovka.

(Q2) 15-20 July. Only half-quadrate (121 snap-traps). Light taiga with dense undergrowth, near Samovo Lakes.

(Q3) 20-26 July. Light taiga almost without undergrowth, approximately 2 km north of the base camp in Kedrovka.

(Q4) 28 July - 3 August. Only half-quadrate (121 snap-traps). Bent grassland, approximately 250 m east of the base camp in Kedrovka.

(Q5) 6-12 August. Light taiga with dense undergrowth, approximately 2 km north of the base camp in Kedrovka.

(Q6) 18-24 August. Clearing in light taiga at Kordon.

In addition, traps were set in lines where this was more appropriate, or snap-traps were placed individually. Overall, three trap lines were set, with the following characteristics (see also Table 2):

(L1) 30 July - 9 August. 19 live-traps in sandy dunes in the surroundings of the base camp in Kedrovka.

(L2) 16-23 August. 19 live-traps in light taiga at Kordon.

(L3) 26-29 August. 242 snap-traps in ecotone between sandy dunes and bent grassland in Kedrovka.

Finally, owl pellets were collected on the Svjatoj Nos isthmus and mammalian remains included in them were identified (AR). The pellets were rather large and probably expelled by one or more of the large owl species which may occur in the area: Eagle Owl *Bubo bubo* (Linnaeus), Ural Owl *Strix uralensis* Pallas or Great Grey Owl *Strix nebulosa* Forster (DH, JM).

All the collected micromammals were weighed and measured (ML, AR, LS), and from selected specimens chromosome sets were prepared (ML, AR, LS). These results will be published elsewhere.

The mammals were identified using the keys by Judin (1971) and Krivošeev (1984). Comparisons with skulls from the Buryat Scientific Center (Ulan-Ude) were also helpful. Nomenclature and species sequence are from Pavlinov and Rossolimo (1987). English names are from Sokolov (1988).

For a general description of the Svjatoj Nos isthmus see Mlíkovský et al. (1992). Detailed geobotanical description was given by Chytrý and Pešout (1992).

Results

Faunal list

Lesser shrew *Sorex minutus* Linnaeus: Collected at Kedrovka on 28-29 July (ML), 9 August (ML), and at Kordon on 17-23 August (6 ex., ML). Also found in owl pellets at Kedrovka (AR).

Laxmann' s shrew *Sorex caecutiens* Laxmann: An adult male was collected at Kedrovka on 11 August (ML).

Shrew *Sorex isodon* Turov: A subadult male was collected near Samovo lake on 17 July (AR), and five subadults at Kordon on 18-24 August (ML).

Eurasian common shrew *Sorex araneus* Linnaeus: Four specimens were collected in light taiga at Kordon on 17-23 August (ML). Also found in owl pellets at Kedrovka (AR).

Large-toothed shrew *Sorex daphaenodon* Thomas: Collected at Kedrovka on 9 August (ML), 12 August (ML), and 28-29 August (ML), and at Kordon on 17 August (ML). Also found in owl pellets at Kedrovka and at Kulinoe (AR).

Shrew *Sorex* sp.: A subadult female, somewhat resembling, but not identical with *Sorex roboratus* Hollister, was collected at Kordon on 17 August (ML).

Eurasian water shrew *Neomys fodiens* (Pennant): A subadult male was collected at Kedrovka on 14 July (AR).

Daubenton' s bat *Myotis daubentoni* (Kuhl): Mistnetted at Kedrovka on 6 August (FF, ML, JM), 8 August (PS), and 27 August (PS), and at Kulinoe on 12 August (10 ex., JM). The species is considered rare and declining in Buryatia (Maturova 1988a). It was found to be very abundant at Kulinoe (JM). This species is included in the Red Data Book of Buryatia (Pronin 1988).

Long-eared bat *Plecotus auritus* (Linnaeus): Single individuals were observed at Kulinoe on 12 August (JM) and mistnetted there on 23 August (FF). This species is included in the Red Data Book of Buryatia (Pronin 1988).

Northern bat *Eptesicus nilssoni* (Keyserling et Blasius): An adult female was mistnetted at Kedrovka on 6 August (FF, ML, JM). This species was formerly unknown to the Svjatoj Nos isthmus and the Zabajkal'skij National Park (Jumov 1990). This species is included in the Red Data Book of Buryatia (Pronin 1988).

Red fox *Vulpes vulpes* (Linnaeus): Droppings and footprints were found at Kedrovka on 17 August (ML).

Brown bear *Ursus arctos* Linnaeus: Footprints of three individuals were registered daily at Kedrovka on 14-20 July (AR, PS). Skeletal remains of a bear were found at Kedrovka on 7 August (ML).

Alpine weasel *Mustela altaica* Pallas: A skull was found at Kovrižka on 22 July (AR, RS).

Weasel *Mustela* sp.: Footprints were recorded between 7-14 July at Kedrovka (AR). At least four weasel species can occur in the area, including *Mustela altaica*, *Mustela nivalis*, *Mustela erminea*, and *Mustela sibirica* (Švecov et al. 1974, Jumov 1990).

Baikal seal *Phoca sibirica* Gmelin: Beached carcasses of young (mostly baby) Baikal seals were regularly found in the Barguzinskij Bay near Kedrovka during July and early August (ML, JM, AR, PS). Since the water level of Lake Baikal rose in 1962, seals are known to frequently visit Lake Arangatuj in autumn. Several hundred individuals were observed in Lake Arangatuj in autumn 1973 (Pastuchov 1977).

Siberian roe deer *Capreolus pygargus* (Pallas): Two individuals were observed at Kordon on 10 August (ML). Droppings were found at Kedrovka on 31 July (ML), and skeletal remains of a red deer were found at Kedrovka on 11 August (ML).

European elk *Alces alces* (Linnaeus): An adult female was observed at Kedrovka on 28 June (DH, PS).

Red squirrel *Sciurus vulgaris* Linnaeus: Observed at Kedrovka on 14 July (DH), 15 July (AR), 9 August (FF), and 30 August (ML), and at Kordon on 22 August (ML).

Siberian chipmunk *Tamias sibiricus* (Laxmann): Common in light taiga in all parts of the isthmus. Also found in owl pellets at Golaja Gora (AR).

Grey-sided vole *Clethrionomys rufocanus* (Sundevall): An adult male was collected at Kedrovka on 9 August (ML). Frequently collected at Kordon on 10 July (AR), and 18-23 August (ML).

Ruddy vole *Clethrionomys rutilus* (Pallas): Frequently collected at Kedrovka on 7 July (AR), 14 July (AR), 20-29 July (ML, AR), and 9 August (ML), near Samovo lakes on 15 July (AR), and at Kordon on 18-24 August (ML). Also found in owl pellets at Golaja Gora (AR).

Muskrat *Ondatra zibethicus* (Linnaeus): Abundant in the marshes. Also found in owl pellets at various localities (AR). Muskrats were introduced to the Svjatoj Nos wetlands in 1936 (Moložnikov 1974). In recent years, approximately 2000 individuals are culled by hunters in the Svjatoj Nos wetlands (V.S. Meľnikov and A.K. Beketov, pers. communication).

Root vole *Microtus oeconomus* (Pallas): Few individuals were collected at Kedrovka between 7-30 July (ML, AR). An adult female was collected at Kordon on 21 August (ML). In owl pellets it formed 85 percent of mammals (AR).

Narrow-skulled vole *Microtus gregalis* (Pallas): Not recorded by us. Three individuals were collected at Kulinoe in 1988 (L.N. Kalinina and B.O. Jumov, pers. communication). This is the first record of the species in the region. The nearest previously known locality of *Microtus gregalis* was 200 km to the south of the Svjatoj Nos isthmus near Zyrjansk (Švecov 1977, Švecov et al. 1984, L.N. Kalinina and B.O. Jumov, pers. communication).

Korean field vole *Apodemus peninsulae* (Thomas): Commonly collected at Kedrovka between 20 July - 29 August (ML, AR). A subadult female was collected near Samovo lakes on 18 July (AR). Also found in owl pellets at Golaja Gora (AR).

House mouse *Mus musculus* Linnaeus - complex: A subadult female was collected at the entrance in the park on 13 July (AR). Taxonomic identity of Buryat mice is unknown as yet (cf. Pavlinov and Rossolimo 1987).

Hare *Lepus timidus* Linnaeus: An individual was observed at Kordon on 11 July (JMa).

Feral mammals

Dog *Canis familiaris* Linnaeus: A pack of six dogs was encountered four-times in July (AR). Two solitary feral dogs were regularly observed at Kedrovka in August (JM)

Horse *Equus caballus* Linnaeus: Two bands of 14 and 18 feral horses, respectively, lived at Kedrovka and Barmašovye Lakes (ML, JM, PS).

Cattle *Bos taurus* Linnaeus: Approximately 50 free-ranging cattle frequented taiga and wetlands between the entrance to the park and Samovo lakes (ML, JM, PS). An additional 200 domestic cattle lived at Kulinoe. They freely visited taiga and wetlands in the area over days, but were closed in a corral at night.

Table 1. Results of trapping micromammals in traps set in quadrates (Q) and lines (L). P = minimum numbers of individuals found in owl pellets. See Material and methods for the description of the samples.

Species	Q1	Q2	Q3	Q4	Q5	Q6	L1	L2	L3	Sum	P
Sorex minutus	-	-	-	1	1	-	-	6	-	8	1
Sorex caecutiens	-	-	-	-	1	-	-	-	-	1	-
Sorex isodon	-	1	-	-	-	1	-	2	-	4	-
Sorex araneus	-	-	-	-	-	2	-	2	-	4	1
Sorex daphaenodon	-	-	-	-	2	-	-	1	3	6	2
Sorex sp.	-	-	-	-	-	-	-	1	-	1	-
Tamias sibiricus	-	-	-	-	-	-	-	-	-	-	1
Clethrionomys rufocanus	-	-	-	-	1	7	-	7	-	15	-
Clethrionomys rutilus	4	3	14	-	9	4	8	3	4	49	5
Ondatra zibethicus	-	-	-	-	-	-	-	-	-	-	12
Microtus oeconomus	2	-	-	1	-	-	-	1	-	4	131
Apodemus peninsulae	-	-	9	-	-	-	14	1	-	24	2
Total	6	4	23	2	14	14	22	24	7	116	155

Quantitative data

Standard methods of trapping micromammals in quadrates and lines (Tab. 1) allowed us to estimate, first in the region under study, some quantitative parameters of the micromammal communities (Tab. 2). Overall, densities were very low, ranging from 4-28 micromammals/ha. Trapping success in snap-traps was very low (0.3-1.6 animals/100 traps/night), that in live-traps was much higher (12.9-18.0 animals/100 traps/night).

Table 2. Characteristics of micromammalian communities sampled in different quadrates and lines, and of that found in the owl pellets. d = number of nights of trap exposition; s = number of species; N = number of individuals; D = population densities of micromammals [number of individuals per hectare]; D_r = relative density of micromammals [number of individuals per 100 traps per night]. See Material and methods for the description of quadrates and lines.

Sample	d	s	N	D	D_r
Q1	4	2	6	6	0.62
Q2	5	2	4	8	0.66
Q3	6	2	28	28	1.58
Q4	6	2	2	4	0.27
Q5	6	5	14	14	1.03
Q6	6	4	18	18	0.89
L1	9	2	22	-	12.86
L2	7	9	24	-	18.04
L3	3	2	7	-	0.96
P	-	8	155	-	-

Discussion

Mammalian fauna

The list of mammalian species registered in the Svjatoj Nos isthmus -- first ever published -- includes 26 wild and three feral species. Of these, however, only three species are proper inhabitants of wetlands: *Neomys fodiens*, *Microtus oeconomus*, and the introduced *Ondatra zibethicus*. In addition, *Sorex minutus* has been found in the wetlands, but it occurred in a wider range of habitats, and *Myotis daubentoni* regularly hunted above the marshes. Two of the feral mammals, horses and cattle, frequently

Table 3. Presence (+) or absence (-) of mammalian species in habitats of the Svjatoj Nos isthmus. Finds of skeletal remains are not included here because of possible post-mortem transport from other habitats. 1 = sandy coastal dunes with sparse vegetation; 2 = border between sandy dunes and sedge marshes; 3 = wet, partly flooded marshes; 4 = bushes in the dryer patches in marshes; 5 = light taiga; 6 = clearing in light taiga; 7 = settlements.

Species	1	2	3	4	5	6	7
Sorex minutus	+	+	+	-	+	-	-
Sorex caecutiens	-	-	-	-	+	-	-
Sorex isodon	-	-	-	+	+	+	-
Sorex araneus	-	-	-	-	+	+	-
Sorex daphaenodon	-	+	-	-	+	-	-
Sorex sp.	-	-	-	-	+	-	-
Neomys fodiens	-	-	+	-	-	-	-
Myotis daubentoni	+	-	+	-	+	-	-
Plecotus auritus	-	-	-	-	+	-	-
Eptesicus nilssoni	+	-	-	-	-	-	-
Vulpes vulpes	+	-	-	-	-	-	-
Ursus arctos	+	-	-	-	+	-	-
Mustela sp.	+	-	-	-	-	-	-
Capreolus pygargus	-	-	-	-	+	-	-
Alces alces	-	-	-	-	+	-	-
Sciurus vulgaris	+	-	-	-	+	+	-
Tamias sibiricus	+	-	-	-	+	-	-
Clethrionomys rufocanus	-	-	-	+	+	+	-
Clethrionomys rutilus	+	+	-	+	+	-	+
Ondatra zibethicus	+	+	+	-	+	-	+
Microtus oeconomus	+	+	+	-	+	-	-
Apodemus peninsulae	+	-	-	-	+	-	+
Mus musculus	-	-	-	-	-	-	+
Canis familiaris	+	-	-	-	-	-	+
Equus caballus	+	+	+	+	+	-	-
Bos taurus	+	+	+	+	+	-	-
Wild species	12	5	5	3	18	4	4
Feral species	3	2	2	2	2	0	1
Total	15	7	7	5	20	4	5

entered marshes and fed there even in rather deep water. Three further species typical of light taiga (*Sorex isodon*, *Clethrionomys rutilus*, and *Clethrionomys rufocanus*), sometimes occurred at dryer patches in the marshes.

The taxonomy of the Siberian shrews of the genus *Sorex* is far from understood and requires further study. Being fully aware of these diffculties, we identified the shrews for the purposes of this paper using the characters given by Judin (1971) and Krivošeev (1984), with special respect to body dimensions and maxillar dentition. The latter character has been used particularly to identify the cryptic species *Sorex isodon/ caecutiens*.

In comparison to the nearby wetlands of the Barguzin valley (Ljamkin 1977), the mammalian fauna of the Svjatoj Nos isthmus is poorer due to the lack of *Myotis mystacinus* (Kuhl), *Mustela eversmanni* Lesson, *Sus scrofa* Linnaeus, *Spermophilus undulatus* (Pallas), *Cricetulus barabensis* (Pallas), *Microtus fortis* Buchner, *Microtus mongolicus* (Radde), and *Micromys minutus* (Pallas). Most of them require a warmer climate and dryer ground and their absence from the Svjatoj Nos isthmus is probably related to the absence of suitable conditions in the area.

One species, *Eptesicus nilssoni*, was recorded from the Svjatoj Nos isthmus for the first time. It has not been previously known even from the whole Zabajkal'skij National Park (Jumov et al. 1989, Jumov 1990). The species is considered widespread, but rare in Buryatia (Maturova 1988b).

Population densities

Standard method of estimating population densities of small mammals by setting snap-traps in quadrates which is widely applied in Europe, has been probably used in Buryatia for the first time. There are therefore no comparable data from the region.

Also a comparison of our results using the trapping success [mammals/ trap/night] is doubtful, because Soviet authors usually use pitfall traps, not snap-traps and live-traps, as we did. Nonetheless, it appears that densities of micromammals estimated by us agree with those reported previously for the region (Švecov et al. 1974). However, shrew species were found at different densities. *Sorex araneus* had a relative density 1.5 in live-traps on the Svjatoj Nos isthmus, but was previously collected only once in the region (Švecov et al. 1984). On the other hand, *Sorex caecutiens* and *Sorex isodon* were rarely found on the Svjatoj Nos isthmus, although Švecov et al. (1984) considered them rather common in the region.

Table 4. Relative densities of micromammals, measured as trapping success [number of specimens/100 traps/night]. Numbers refer to biotopes as described in the caption of Table 3. Letters refer to the style of catching: A = lines of live-traps, B = lines of snap-traps, C = quadrates of snap-traps.

Species	1A	1C	2B	3C	5A	5C	6C
Sorex minutus	-	-	-	0.1	4.5	0.1	-
Sorex caecutiens	-	-	-	-	-	0.1	-
Sorex isodon	-	-	-	-	-	0.2	0.1
Sorex araneus	-	-	-	-	1.5	-	-
Sorex daphaenodon	-	-	0.4	-	0.8	0.1	-
Sorex sp.	-	-	-	-	0.8	-	-
Clethrionomys rufocanus	-	-	-	-	5.3	0.1	-
Clethrionomys rutilus	4.7	0.4	0.6	-	2.2	0.7	0.3
Microtus oeconomus	-	0.2	-	0.1	0.1	0.8	-
Apodemus peninsulae	8.2	-	-	-	0.8	0.6	-
Total	12.9	0.6	1.0	0.3	18.0	1.9	0.9

Conclusions

We registered in the Svjatoj Nos isthmus 24 species of wild mammals, and three species of feral mammals (dog, horse, cattle). This raised the overall number of mammalian species known from the area to 29. One species, *Eptesicus nilssoni*, was observed in the region for the first time.

Standard trapping techniques showed that the population densities of micromammals were generally low during the study.

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REPTILES OF THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

R. Samek and L. Samková
Lipová 1457, CS-288 00 Nymburk, Czechoslovakia.

Abstract: Three reptile species were found in the Svjatoj Nos wetlands and in adjacent parts of the Svjatoj Nos peninsula. They include *Lacerta vivipara*, *Natrix natrix*, and *Agkistrodon halys*.

Key-words: Lake Baikal, Svjatoj Nos wetlands, reptiles, distribution, biometry.

Introduction

Three species of reptiles are known to occur in the region of the Svjatoj Nos peninsula (e.g. Bannikov et al. 1977, Jumov 1990): *Lacerta vivipara*, *Natrix natrix*, and *Agkistrodon halys*. None of these species are included in the Red Data Book of the USSR (Aleksandrovskaja et al. 1988), but *Natrix natrix* is included in the Red Data Book of Buryatia (Pronin 1988).

First brief comments on the reptiles of the Svjatoj Nos peninsula can be found in Turov (1923, 1924). Further observations were supplied by Skalon and Gagina (1955), Gagina and Skalon (1965), Moložnikov (1970), Švecov (1977, 1988), and Jumov (1990).

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Material and methods

Reptiles were observed in the Svjatoj Nos wetlands and adjacent parts of the Svjatoj Nos peninsula between 25 June -26 July (R. Samek, RS), and between 1 August - 28 August 1991 (L. Samková, LS). The work focused on the wetlands, but occasional observations from adjacent areas were included as well. See Mlíkovský et al. (1991) for the general description of the Svjatoj Nos wetlands, and Chytrý and Pešout (1991) for the description of respective plant communities.

Visual observations of reptiles were combined with their catching, following recommendations by Darevskij (1987). Measurements were taken according to Bannikov et al. (1977). Accuracy was 0.1 mm in lizards, and 1 mm in snakes. The following measurements were registered for lizards (L) and snakes (S):

L = body length (L,S); Lcd = tail length (L,S); Sq = number of squamata (L,S); Pfm = number of thigh pores per thigh (L); Ventr = number of ventralia (S); Scd = number of subcaudalia (S); Lab = number of supralabialia (S); Temp = number of temporalia.

Animals were marked by standard methods (cutting a finger in juvenile lizards, and cutting part of a ventrale in adult lizards and snakes).

Faunal list

Order Squamata

Family Lacertidae

Lacerta vivipara Jacquin

This species was widely distributed over the Svjatoj Nos wetlands and adjacent parts of the Svjatoj Nos peninsula (Fig. 1):

(1) Kordon. Found to be abundant during observations on 10-12 July (PP, PS) and 16-19 August (LS). On 10-12 July, a gravid female was caught which gave birth on 26 July to 8 young and a dead gravid female was found, which included 6 young (PP, RS).

(2) Makarovo (village). On 13 July, a dead *Agkistrodon halys* was found, which had a gravid *Lacerta vivipara* female in its stomach. The lizard included five embryos (RS).

(3) Taiga between Makarovo and Glinka. An adult observed on 13 July (RS).

(4) Glade near Glinka. An adult observed on 17 July (AR).

(5) Golaja Gora. Found to be abundant during observations on 20-21 July (RS), and 5 August (LS).

(6) Kulinoe. Several individuals observed on 21-25 July (RS), 13-14 August (LS), and 22 August (LS).

(7) Shallow pool near Kulinoe. A single adult seen on 23 July (RS), a juvenile caught on 12 August (LS).

Table 1. Measurements of juvenile and adult *Lacerta vivipara* from the Svjatoj Nos isthmus.

	Females	Males	Juveniles
n	13	10	8
L	55.6 (47.1-65.2)	0.9 (44.0-56.4)	29.7 (25.2-32.8)
Lcd	77.4 (61.1-82.0)	80.8 (62.9-86.1)	40.1 (35.6-42.8)
L/Lcd	0.7 (0.6-0.8)	0.6 (0.5-0.7)	0.7 (0.7-0.8)
Sq	32.0 (29-37)	31.0 (29-32)	-
Pfm	9.9 (8-11)	10.8 (9-12)	-

(8) Zmeinaja Bay. Two freshly born juveniles observed on 23 July (AR).

(9) Kurtuj creek near the road between Glinka and Kurbulik. One adult observed on 24 July (PP, RS).

(10) Kedrovka. Adult and/or juvenile individuals observed on 24 July (RS), 29 July (ML), 20 August (JM), and 25 August (LS).

(11) Road between Glinka and Kurbulik. Dead female found on 14 August (LS).

(12) Pools near the road between Kordon and Ust' -Barguzin, approximately 4 km from Kordon. An adult observed on 19 August (LS). An adult was seen on a small dry island inside the marshes nearby this locality on 19 August (PS).

(13) Southernmost Barmašovoe Lake. Skin of a lizard found on 21 August (JM, LS).

The Viviparous Lizard was recorded for the first time from the Svjatoj Nos isthmus by Turov (1923, 1924). Moložnikov (1970) and Švecov (1977) mentioned that this species is common around northern Baikal, but knew of no record from the Svjatoj Nos isthmus. Our observations listed above indicate that *Lacerta vivipara* is a common species of that region. It is of interest that *Lacerta vivipara* is rare in the nearby Barguzin valley (Ljamkin 1969).

23 adult and 8 juvenile lizards were measured (Tab. 1). The values obtained generally agree with those given by Bannikov et al. (1977).

Family Colubridae

Natrix natrix (Linnaeus)

This species was found in three localities only (Fig. 2):

(1) Zmeinaja Bay. Common; observed on 18 July (4 adults and one juvenile male, RS), and 23 July (5 adults and 16 juveniles, AR). In two gravid females, caught on 18 July, 5 and 8 eggs, respectively, were tangible (RS). Two eggs were found in a pool near a hot spring on 18 July. Their dimensions were 36.0 x 19.6 mm, and 34.5 x 21.7 mm, respectively (RS).

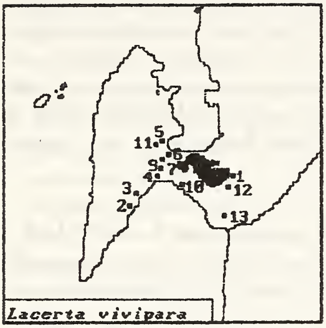
This locality was mentioned already by Turov (1924) who found many skins here and observed numerous snakes. Snakes were still abundant in the locality in 1959 (V.V. Čerepanov in Moložnikov 1970). However, Moložnikov (1970) observed in 1964 only a single individual and several skins, and was not able to see any snakes in this locality in 1967 in spite of considerable effort. A. Maryčev (in Jumov 1990) counted in late July 1988 in this locality approximately 20-30 animals. This figure agrees with our observations.(2) Kulinoe. Local shepherd found a skin in early July, which was later identified as that of *Natrix natrix*. Two adults were observed on 21 July in hot spring (PP). Skalon and Gagina (1955) mentioned that *Natrix natrix* were abundant in this locality (see also Moložnikov 1970). The species is now rare here according to our observations.

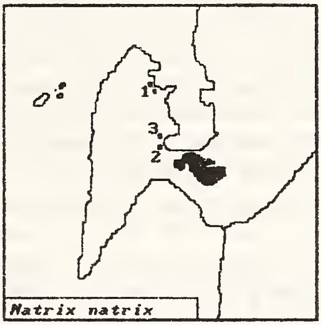
(3) Golaja Gora. A female caught on 15 August (LS). This locality was unknown prior to our observations.

In addition, Moložnikov (1970) wrote that *Natrix natrix* occurs in Lake Arangatuj and in Čivyrkujskij Bay, but gave no details. Moreover, local fishermen informed us that snakes are living in Barguzinskij Bay in the village Makarovo. We were not able to verify this information, however.

In general, the distribution of *Natrix natrix* in northern Buryatia is very patchy and dependent on the presence of hot springs (Gagina 1955, Gagina and Skalon 1965, Ljamkin 1969, Škatulova et al. 1978).

Five snakes were measured with the following results. One juvenile had L = 323, Lcd = 68, L/Lcd = 4.8, Sq = 19, Ventr = 167, Scd = 55, Lab = 7, Temp = 1+3. Four adult snakes had L = 596.8 (544-637), Lcd = 128.3 (120-138), L/Lcd = 4.7 (4.5-4.7), Sq = 19, Ventr = 170.8 (167-173), Scd = 56.8 (55-59), Lab = 7, Temp = 1 + 3. The values obtained generally agree with those given in literature (Ljamkin 1969, Bannikov et al. 1977, Chabaeva et al. 1982, Švecov and Maturova 1988).





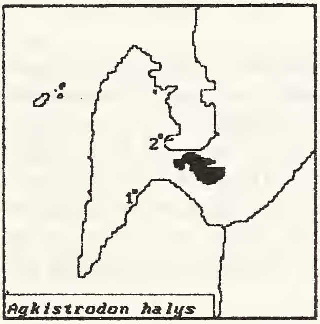


Fig. 1-3. Records of *Lacerta vivipara, Natrix natrix* and *Agkistrodon halys* on the Svjatoj Nos isthmus, Lake Baikal.

Family Crotalidae

Agkistrodon halys (Pallas)

This species was observed only in three localities in the Svjatoj Nos peninsula (Fig. 3):

(1) Makarovo. One dead juvenile found on 13 July (RS).

(2) Monachov. A worn dead adult found on 21 July by a group of Soviet mammaliologists (L+Lcd = 527 mm). Another specimen (see below for measurements) was found in the collections of the research field station at Monachovo (RS). No information was attached to the specimen, but it was collected at Monachovo according to A.V. Nekrasov (pers. communication).

(3) Golaja Gora. An unidentified black snake was observed on 21 July at the border between a dry hillside and a forest (RS). The biotope indicates that this was a melanistic form of *Agkistrodon halys*.

Skalon and Gagina (1955) found *Agkistrodon halys* common at Zmeinaja Bay. We visited the locality on 18 and 23 July, but found there no signs of these snakes. Moložnikov (1970) found *Agkistrodon halys* to be common in hills in the Svjatoj Nos peninsula, and registered it also from the village Makarovo. In contrast to *Natrix natrix*, *Agkistrodon halys* is not confined in its distribution in northern Buryatia to hot springs (Ustinov and Skrjabin 1963).

A single juvenile specimen had L = 192, Lcd = 27, L/Lcd = 7.1, Sq = 23, Ventr = 168, Scd = 41. A single adult specimen had L = 407, Lcd = 77, L/Lcd = 5.3, Sq = 23, Ventr = 156, Scd = 46. These values agree with those given in literature (Ustinov and Skrjabin 1963, Bannikov et al. 1977).

Discussion

Of the five reptile species, which live in northern Buryatia, three were recorded from the Svjatoj Nos wetlands and/or the Svjatoj Nos peninsula (*Lacerta vivipara, Natrix natrix,* and *Agkistrodon halys*). The rare *Elaphe dione* was observed in the Barguzinskij reserve (Borkin and Krever 1987, Dvorjabkin 1988) and on the island Ol' chon (Bozorobskij and Litvinov 1988). *Vipera berus* is known from the Barguzin valley and the Barguzinskij range (Švecov 1988). Reasons, why the latter two species do not occur in the Svjatoj Nos area are unknown. Moreover, a possibility still exists that they will be discovered there

Conclusions

Three reptile species were observed in the Svjatoj Nos region. Of them, *Lacerta vivipara* is common in a wide range of biotopes. *Natrix natrix* lives only in close vicinity to hot springs. *Agkistrodon halys* does not occur in the Svjatoj Nos wetlands, but locally occurs in the Svjatoj Nos peninsula.

Further research is required to estimate population numbers of these species and to point towards possible ways of their protection.

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J. Mlíkovský and P. Stýblo, Eds.
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AMPHIBIANS OF THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

R. Samek and L. Samková
Lipová 1457, CS-288 00 Nymburk, Czechoslovakia.

Abstract: Three species of amphibians were observed in the Svjatoj Nos wetlands, including *Salamandrella keyserlingi*, *Rana amurensis*, and *Rana arvalis*.

Key-words: Lake Baikal, Svjatoj Nos wetlands, Amphibia, distribution, biometry.

Introduction

Only three species of amphibians were listed for the Svjatoj Nos wetlands in literature: *Salamandrella keyserlingi*, *Rana amurensis*, and *Rana arvalis* (Bannikov et al. 1977, Jumov 1990). None of these species were included in the Red Data Book of the USSR (Aleksandrovskaja et al. 1988), but *Rana arvalis* was included in the Red Data Book of Buryatia (Pronin 1988).

First brief comments on the batrachofauna of the Svjatoj Nos wetlands can be found in Turov (1924). More detailed observations were made only in the 1960s (Moložnikov 1970). Švecov (1977, 1988) added a few more recent observations.

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Material and methods

Amphibians were observed and collected in the Svjatoj Nos wetlands between 25 June - 26 July by Radko Samek (RS) and between 1-28 August 1991 by Ludmila Samková (LS). For a general description of the Svjatoj Nos wetlands see Mlíkovský et al. (1992); plant communities were described by Chytrý and Pešout (1992).

Observations were made according to the methods recommended by Garanin and Pančenko (1987) for batrachological research in natural reserves, where visual observations are combined with catching the animals. Measurements were taken as described by Bannikov et al. (1977), with an accuracy of 0.1 mm. The following measurements were taken in Caudata (C) and Anura (A), respectively (all measurements are in mm):

L = body length (C,A); Lcd = tail length (C); Lc = head length (C,A); Pa = forelimb length (C); Pp = hindlimb length (C); Dro = snout length (A); Lo = maximum diameter of the orbit (A); Ltym = maximum diameter of tympanum (A), F = thigh length (A), T = shin length (A); Dp = length of the 1st finger of hindlimb (A), and Cint = length of the basis of metatarsal tubercle (A); m = body mass [g] (C).

The measured animals were marked by cutting a forelimb finger.

Faunal list

Order Caudata

Family Hynobiidae

Salamandrella keyserlingi Dybowski

This species is often included in the genus *Hynobius*, but Zhao and Hu (1984) pointed out that it markedly differs from other *Hynobius* species, which inhabit China, Korea and Japan, and deserves separation at the genus level (see also Engelmann et al. 1985, Borkin 1988).

Salamandrella keyserlingi was found in 4 localities in the Svjatoj Nos wetlands (Fig. 1):

(1) Kedrovka. Eight adults under fallen pine trunks on sandy dunes at Baikal shore on 12 July (AR, RS). 1 adult plus 3 juveniles on 20 August in the same place (LS).

(2) Shallow pool near road to Kulinoe. Three larvae on 22 July (RS). Adults were not observed.

(3) Barmašovye Lakes. Three adults and 10 juveniles on 21-22 August (JM, LS). All near pools nearby the southernmost lake. The juveniles

Table 1. Weights [g], measurements [mm], and body proportions in *Salamandrella keyserlingi* from the Svjatoj Nos wetlands. Mean and range are given.

	Larvae		Juveniles		Adults	
n	3		13		13	
L	21.0	(20.5-21.9)	27.7	(22.3-34.6)	51.5	(43.4-56.3)
Lcd	17.8	(16.6-19.9)	22.1	(19.1-27.3)	42.9	(41.2-44.6)
Lc	5.3	(4.9-5.5)	4.7	(3.5-7.2)	10.0	(9.0-11.5)
Pa	4.7	(4.6-4.8)	6.5	(5.2-8.6)	12.5	(11.0-13.7)
Pp	5.3	(4.9-5.9)	7.5	(6.5-9.1)	13.2	(11.5-15.5)
L/Lcd	1.2	(1.0-1.3)	1.3	(1.2-1.3)	1.2	(1.0-1.4)
(L-Lc)/Lc	3.0	(2.7-3.2)	5.0	(3.8-5.9)	4.2	(3.5-5.5)
Pa/Pp	0.9	(0.8-1.0)	0.9	(0.8-0.9)	0.9	(0.7-1.0)
m	-		-		4.1	(2.5-4.5)

were found mostly under trunks near water, but one adult was caught approximately 22 m further from the water at the taiga border.

(4) Samovo Lake. One adult on 22 August near Baikal shore (LS).

Salamandrella keyserlingi was for the first time observed in the Svjatoj Nos wetlands in 1959 by V.V. Čerepanov (in Moložnikov 1970), but exact localities were not given.

The proportions of *Salamandrella keyserlingi* from the Svjatoj Nos wetlands agree with those given by Bannikov et al. (1977), but the overall size and body mass of the Svjatoj Nos animals are lower (Table 1). In particular, body length was 43.4-56.3 mm (mean = 51.5 mm) in adult Svjatoj Nos animals, while it is 50.1-68.0 according to Bannikov et al. (1977). Adult animals from the Svjatoj Nos wetlands weighed 2.5-4.5 g (mean = 4.1 g), while standard body mass of this species is 4.6-8.1 g (Bannikov et al. 1977).

Order Anura

Family Ranidae

***Rana amurensis* Boulenger**

This species was observed only in three localities in the Svjatoj Nos wetlands (Fig. 2):

(1) Kedrovka. One adult on 7 August (ML, LS).

(2) Northernmost Barmašovoe Lake. Three older juveniles on 23 August (JM, LS).

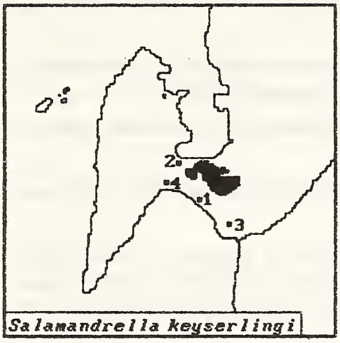
(3) Pools near the road between Kordon and Usť-Barguzin, approximately 4 km from Kordon. Three juveniles on 19 August (LS, PS).

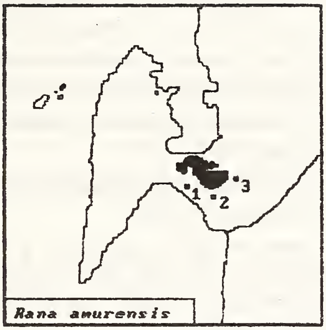
The only previous record of *Rana amurensis* from the Svjatoj Nos area was from the Okunevaja Bay in Čivyrkujskij Bay (Turov 1924). On the one hand, this species is considered common in the valleys of NW Zabajkaľe, although it always falls behind *Rana arvalis* in numbers (Ljamkin 1969). On the other hand, *Rana amurensis* is the dominating frog of the Selenga delta in southern Baikal (Švecov 1963).

Measurements and proportions of the Svjatoj Nos animals (Tab. 2) approximately agree with those given by Bannikov et al. (1977). It is notable that already juvenile *Rana amurensis* had relatively short hindlimbs which served as a distinctive characteristics of this species contra *Rana arvalis* (See Kaper 1965 for the ontogeny of limb proportions in *Rana* spp.).

Table 2. Measurements [mm] and proportions of adult *Rana amurensis* and *Rana arvalis* from the Svjatoj Nos wetlands. Mean and range are given.

	R. amurensis	*R. arvalis*
n	1	12
L	49.1	48.3 (44.2-53.9)
Lc	18.9	19.6 (18.5-20.5)
Lo	4.1	4.0 (3.1-4.4)
Ltym	3.5	3.0 (2.7-3.9)
F	23.2	23.9 (22.0-26.8)
T	25.6	23.3 (21.7-26.0)
L/Lc	2.6	2.6 (2.5-2.7)
Lo/Ltym	2.1	1.3 (1.2-1.6)
L/F	2.1	2.0 (1.8-2.1)
L/T	1.9	2.1 (1.8-2.2)





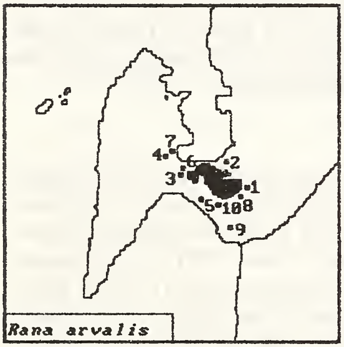


Fig. 1-3. Records of *Salamandrella keyserlingi, Rana amurensis* and *Rana arvalis* on the Svjatoj Nos isthmus, Lake Baikal, in summer 1991.

Rana arvalis Nilsson

This species was recorded from 10 localities in the Svjatoj Nos wetlands (Fig. 3):

(1) Kordon. Three adults (incl. one light) on 12 July (PP, RS).

(2) Kovrižka. One light adult on 21 July (PP, RS).

(3) Shallow pool near Kulinoe. Tadpoles and small frogs observed on 21 July (RS). Adults were not found.

(4) Forest pool near the road between Glinka and Kurbulik. Tadpoles and one light adult on 24 July (RS).

(5) Swamps near Kedrovka. Three adults on 1 August (LS), one adult on 7 August (TK, LS), one juvenile on 25 August (LS, PS).

(6) Kulinoe. Abundant juveniles on 10-14 August (JM, LS), two adults on 12 August (LS).

(7) Golaja Gora (small swamp near Čivyrkujskij Bay). Three adults and two juveniles on 14 August (LS).

(8) Pools near the road between Kordon and Usť-Barguzin, approximately 4 km from Kordon. Three juveniles on 19 August (LS, PS).

(9) Southern Barmašovye Lakes. Four juveniles (incl. two older ones) on 25 August (JM, LS).

(10) Northernmost Barmašovoe Lake. One adult and one older juvenile on 25 August (JM, LS).

Rana arvalis is limited to a few localities in Buryatia (Švecov 1963, Litvinov et al. 1969, Moložnikov 1970, Borkin and Krever 1987, Švecov and Maturova 1988), incl. the Svjatoj Nos wetlands (Moložnikov 1970, Jumov 1990).

In size and measurements (Tab. 2), the Svjatoj Nos animals generally agree with data by Bannikov et al. (1977), but index Lo/Ltym is much lower, being 1.2-1.6 (mean = 1.3) in the Svjatoj Nos animals, while the standard values are 1.4-2.6 according to Bannikov et al. (1977).

Discussion

All three amphibian species registered from the Zabajkaľskij National Park (Jumov 1990) were found in the Svjatoj Nos wetlands. *Rana amurensis* was rediscovered there after almost 70 years, when the only former observation was made in the early 1920s by Turov (1924). *Hyla japonica* Günther is said to occur in the nearby Barguzin valley (Ljamkin 1969, Chabaeva 1988), but has not yet been found in the Svjatoj Nos wetlands. No other amphibian species were found in NW Pribajkaľe (Elpaťevskij 1906, Nikoľskij 1918, Terenťev and Černov 1949, Moložnikov 1970, Bannikov et al. 1977, Švecov 1977, 1988, Škatulova et al. 1978, Borkin and Krever 1987, Bozorobskij and Litvinov 1988).

Conclusions

The Svjatoj Nos wetlands were found to be an important region for the amphibians in Buryatia. One of them, *Rana arvalis* is included in the Red Data Book of Buryatia (Pronin 1988). The region is thus worthy of protection.

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Ecology of the Svjatoj Nos wetlands, Lake Baikal.
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COMMENTS ON THE ICHTHYOFAUNA OF THE SVJATOJ NOS WETLANDS AND ADJACENT BAYS OF LAKE BAIKAL

R. Samek

Lipová 1457, CS-288 00 Nymburk, Czechoslovakia.

Abstract: 13 fish species were collected in the Svjatoj Nos wetlands and adjacent bays of Lake Baikal. Abundant occurrence of *Parasilurus asotus* in Barguzinskij Bay was remarkable.

Key-words: Lake Baikal, Svjatoj Nos peninsula, fish, distribution.

Introduction

The ichthyofauna of Lake Baikal is unique in that more than one half of the species are endemic to the lake (Berg 1923, 1948-1949, Taliev 1955, Černjaev 1973). The overall number of fish species given for Lake Baikal system was 33 (Berg 1923), 36 (Berg 1949), 52 (Korjakov 1978, Moskalenko et al. 1978, Jánský 1989), 54 (Kubečka 1987), 57 (Karasev 1987), and 71 (Egorov 1985), respectively.

None of these species were included in the Red Data Book of the USSR (Aleksandrovskaja et al. 1988), but five species are listed in the Red Data Book of Buryatia (Pronin 1988): *Acipenser baeri stenorrhynchus* natio *baicalensis* Nikoľskij in category II; *Salvelinus alpinus erythrinus* (Georgi) and *Tinca tinca* (Linnaeus) in category III; *Hucho taimen* (Pallas) in category IV; and *Thymallus arcticus baicalensis* natio *brevipinnis* Svetovidov in category V.

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Material and methods

Fish were collected during 25 June - 26 July 1991 (R. Samek) and 1-28 August 1991 (L. Samková) in small ponds in the Svjatoj Nos wetlands, wetland channels, and also in Barguzinskij and Čivyrkujskij Bays. The fish were hooked, caught in nets, and obtained from local fishermen. The research focused on the Svjatoj Nos wetlands, but data of the fish fauna from the adjacent Baikal bays was included as well. The fish were measured and some chromosomal preparates were prepared. This data will be published elsewhere. For the biometry of *Phoxinus percnurus* see Samek and Samková (1992).

Fish were identified using keys by Berg (1948-1949), Egorov (1985), and Karasev (1987).

The Svjatoj Nos wetlands are described in detail by Mlíkovský et al. (1992), aquatic plant communities by Chytrý and Pešout (1992).

Results

Overall, 13 fish species were collected in four lakes in the Svjatoj Nos wetlands and in the two adjacent Baikal bays. Faunal lists are as follows:

Lake Arangatuj: *Esox lucius* Linnaeus, *Carassius auratus* (Linnaeus), *Lota lota* (Linnaeus), *Perca fluviatilis* Linnaeus;

Barmašovye Lakes: *Carassius auratus* (Linnaeus), *Perca fluviatilis* Linnaeus;

Kulinoe: *Phoxinus percnurus* (Pallas);

Samovo Lake: *Phoxinus percnurus* (Pallas);

Barguzinskij Bay: *Acipenser baeri* Brandt, *Coregonus lavaretus pidschian* Gmelin, *Coregonus autumnalis* (Pallas), *Rutilus rutilus lacustris* (Pallas), *Leuciscus leuciscus baicalensis* (Dybowski), *Leuciscus idus* (Linnaeus), *Cyprinus carpio haematopterus* Temminck et Schlegel, *Parasilurus asotus* (Linnaeus);

Čivyrkujskij Bay: *Coregonus lavaretus pidschian* (Pallas), *Coregonus autumnalis migratorius* (Georgi), *Esox lucius* Linnaeus, *Rutilus rutilus lacustris* (Pallas), *Leuciscus leuciscus baicalensis* (Dybowski), *Perca fluviatilis* Linnaeus.

Discussion

The fish species listed above for Lake Arangatuj agree with those given for that lake by Kožov (1962), Korjakov (1978) and Karasev (1987). Of the fish species listed by Mamontov (1977) and Karasev (1987) as common in closed lakes of Zabajkaľe, only *Nemachilus barbatulus toni* (Dybowski) was not found.

In Barguzinskij Bay, the most common prey in August was *Parasilurus acotus* (Linnaeus). This species was introduced to Baikal after 1945 (Moskalenko et al. 1978) and Karasev (1987) listed it as a rare species. Its abundance in our August collection might be caused by specific catching methods. Small unidentified Cottocomephoridae were found in the stomachs of *Parasilurus acotus* (P. Stýblo, pers. communication), so that the possibility of negative influence of *Parasilurus acotus* on the populations of the Cottocomephoridae should be evaluated in the future. The other fish species found in Barguzinskij and Čivyrkujskij Bays agree with those given in literature (Kožov 1962, Moskalenko et al. 1978, Karasov 1987).

Conclusions

Ichthyological research was only marginally included in the program of the 1991 Svjatoj Nos expedition. Lake Baikal is rich in fish, but most of the respective research was done in its main water basin, while less attention has been given to water systems of the adjacent wetlands. Special ichthyological research should be carried out in the Svjatoj Nos wetlands.

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BIOMETRY OF THE SWAMP MINNOW *PHOXINUS PERCNURUS* (PISCES: CYPRINIDAE) FROM THE SVJATOJ NOS WETLANDS, LAKE BAIKAL

R. Samek and L. Samková
Lipová 1457, CS-288 00 Nymburk, Czechoslovakia

Abstract: Swamp minnows *Phoxinus percnurus* were collected in two pools in the Svjatoj Nos wetlands. On each of the 115 individuals, three meristic, 32 mensural and 49 proportionate characters were measured. A biometrical analysis revealed phenotypic differences between the two populations.

Key-words: Lake Baikal, Svjatoj Nos wetlands, swamp minnow, biometry.

Introduction

The swamp minnow *Phoxinus percnurus* (Pallas) is a widely distributed fish of the northern Palearctic. Previous studies have shown that it exhibits considerable intraspecific variability, both in the European part of its area (Lorec and Wolski 1910, Berg 1912, Seligo 1916, Kulmatycki 1920, Soldatov 1924, Kaj 1953, Nikoľskij 1956, Kulamowicz and Jazdzewski 1960, Kulamowicz 1963, Oliva 1963, Žukov 1965, Gąsowska and Rembiszewski 1967) and in Siberia (Dybowski 1874, Berg 1912, Karantonis et al. 1956, Nikoľskij 1956, Kirillov 1962, 1972, Novikov 1966, Gąsowska and Rembiszewski 1967, Karasev et al. 1983).

For the first time, the swamp minnow was found in marshy pools of the Baikal system by Georgi (1775), who described it under the name *Cyprinus tinca*. Subsequent authors confirmed abundant occurrence of this species in the area (see Samek 1992), but no comprehensive biometrical study of the Baikal population of the swamp minnow had been conducted as yet. Below we present a biometrical study of *Phoxinus percnurus* from two local populations of the Svjatoj Nos wetlands, Lake Baikal.

Acknowledgments: This work was made during the 1991 Svjatoj Nos expedition. Ivo Dobšíček and Pavel Pešout helped us to collect material in the field. Helena Popová and Ondřej Šustr assisted us in elaborating the material. Ota Oliva made helpful comments on earlier drafts of the manuscript. We are obliged to all of them.

Material and methods

Swamp minnows were collected in two localities in the Svjatoj Nos wetlands, Lake Baikal:

(1) Kulinoe: marshy pool (457 m a.s.l.). According to local inhabitants it originated in 1962, when the Irkutsk dam was finished and the water level of Lake Baikal was raised by 140 cm (Jánský 1989). The area of the pool is approximately 25000 m^2. The water is brownish and less transparent. *Phoxinus percnurus* is the only fish species inhabiting the pool (Samek 1992). Overall, 98 specimens of *Phoxinus percnurus* were collected here, including 45 on 22 July, 41 on 25 July, and 12 on 11-12 August.

(2) Samovo lake: marshy pool (459 m a.s.l.), approximately 30 m from Lake Baikal. The area of the lake is approximately 30000 m^2. Water is slightly brownish, but transparent. *Phoxinus percnurus* is probably the only fish species living in this lake (Samek 1992). Samovo lake is about 4.7 km south of Kulinoe. Seventeen specimens of *Phoxinus percnurus* were collected here on 25-26 August.

The collected specimens were preserved in 4% formol. Measurements were made to the nearest 0.1 mm. Measurements were taken following Berg (1923, 1948-1949) and Holčík and Hensel (1972). Measurements were tested for significance using the t-test, modified for different sample sizes and different standard deviations, and x^2-test (Sachs 1974).

Swamp minnows collected in August were prepared for chromosomes. The results will be published elsewhere.

Results and discussion

Statistically significant differences ($p < 0.05$) between the Kulinoe and Samovo populations were found in two meristic eight absolute, and 10 proportionate measurements (Appendix 1). In particular, swamp minnows from Kulinoe tended to have (1) more slender body, (2) longer and more slender caudal peduncle, (3) longer dorsal and anal fins, (4) more numerous soft dorsal fin rays, (5) larger distance between the ventral and anal fin, (6) less numerous lateral line scales, and (7) differently shaped head.

These findings indicate that swamp minnow populations from Kulinoe and Samovo lakes are sufficiently isolated from each other and/or that life conditions in the two pools are sufficiently different to modify the phenotype of the fish. Gąsowska and Rembiszewski (1967), who studied the variability of swamp minnows in Poland, observed that phenotypic variability was great both within and between localities and concluded that this variation apparently has no taxonomic value. This may apply to the Svjatoj Nos swamp minnows as well.

Summary

A biometrical study of swamp minnows from the Svjatoj Nos wetlands revealed phenotypic differences between sub-populations from Kulinoe and Samovo lakes.

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Appendix 1.

Measurements of the swamp minnow *Phoxinus percnurus* from the Svjatoj Nos wetlands. Mean (X), standard deviation (SD), and range are given. Means of characters from two isolated lakes are compared by t-test and x^2-test, respectively (**, $p < 0.01$; *, $0.01 < p < 0.05$; -, $p > 0.05$). A = meristic characters, B = mensural characters [mm], C-L = proportionate characters [%], in relation to body length (C), head length (D), skull width (E), preorbital distance (F), postorbital distance (G), maximum body depth (H), distance between insertions of pectoral and ventral fins (J), distance between insertions of ventral and anal fins (K), and length of caudal peduncle (L).

Character	Kulinoe (n=98)			Samovo Lake (n=17)			
	Range	X	SD	Range	X	SD	Sign.
A							
lateral line scales	72-88	8.3	6.89	75-89	81.2	4.86	2.12*
soft dorsal fin rays	7-8	7.1	0.28	6-7	6.6	0.34	7.09*
soft anal fin rays	7-8	7.2	0.41	7-8	7.4	0.49	0.87
B							
total body length	52.5-148.5	94.9	16.94	82.8-137.5	102.7	14.30	2.02
body length	42.8-125.3	78.2	14.46	65.2-113.2	84.6	12.05	1.96
head length	12.0-34.9	21.9	4.12	18.2-32.3	22.8	3.41	0.97
head depth at neck	7.4-26.8	15.0	3.05	11.6-23.2	16.5	2.90	1.95
head depth through eye	5.5-18.0	11.2	2.30	9.1-16.3	11.9	1.84	1.39
width of skull	3.1-12.7	7.2	1.62	5.8-10.3	7.8	1.27	1.72
max. width of head	7.3-23.0	13.1	3.13	7.3-18.8	13.5	2.89	0.52
preorbital distance	3.2-10.9	5.9	1.41	5.0-9.1	6.5	1.17	1.89
postorbital distance	5.1-18.5	11.1	2.47	9.0-16.7	11.6	1.99	0.92
horizontal eye diameter	2.8-7.9	5.2	0.75	4.8-6.8	5.4	0.56	1.29
vertical eye diameter	3.0-7.0	5.2	0.69	4.3-7.0	5.4	0.64	1.18
max. body depth	9.9-33.9	20.9	3.93	18.1-34.3	23.7	4.67	2.33*
min. body depth	4.6-15.0	8.6	1.75	7.8-13.4	9.8	1.71	2.66*

max. body width	6.9-23.2	13.8	3.10	12.8-18.7	14.6	2.28	1.26
max. body circumfer.	26.8-122.6	59.9	12.14	56.5-96.2	68.8	11.92	2.83**
antedorsal distance	26.1-77.9	48.1	9.05	40.5-71.7	52.2	7.84	1.94
postdorsal distance	14.5-35.9	24.1	4.11	21.3-35.3	25.6	3.30	1.66
anteventral distance	39.5-63.0	44.0	8.64	31.5-67.8	47.0	8.14	1.39
anteanal distance	28.8-89.3	55.2	8.96	44.8-81.8	58.8	8.96	1.53
dorsal fin length	3.30-13.4	7.9	1.59	6.1-11.8	8.8	1.62	2.12*
dorsal fin depth	7.2-18.9	12.5	2.03	8.6-15.9	12.3	1.96	0.39
anal fin length	3.4-12.8	7.1	1.26	6.2-8.9	7.6	0.98	1.85
anal fin depth	4.8-15.0	9.5	1.56	7.2-12.4	9.5	1.49	0
pectoral fin length	6.1-18.2	11.5	1.98	9.2-16.6	12.5	1.89	2.00
ventral fin length	5.2-13.6	9.2	1.55	8.3-12.7	10.1	1.39	2.42*
P-V	11.4-36.8	22.4	4.71	19.8-36.2	24.5	4.42	1.79
V-A	7.9-24.3	15.1	3.19	11.2-20.2	15.6	2.29	0.78
caudal fin length (U. lobe)	9.2-23.3	16.5	2.90	13.3-22.0	17.2	2.44	1.06
caudal fin length (L. lobe)	9.2-23.5	16.2	2.84	10.2-20.9	16.6	2.96	0.52
length of caudal peduncle	9.1-24.9	16.0	4.04	13.3-22.3	17.7	2.39	2.40*
depth of caudal peduncle	8.9-15.8	10.2	2.08	9.0-16.9	12.2	2.03	3.74**
width of caudal peduncle	3.6-11.8	6.5	1.78	6.1-11.3	8.2	1.39	4.45**

C

head length	22.0-28.9	27.0	0.65	26.7-32.5	28.0	1.47	2.76*
head depth at neck	17.2-23.0	19.2	1.09	18.3-20.8	19.4	0.92	0.80
head depth through eye	12.5-16.6	14.3	1.04	13.3-15.2	14.1	0.56	1.16
skull width	7.2-15.0	9.5	1.12	8.4-9.9	9.2	0.43	1.95
max. head width	10.7-22.5	16.6	1.55	14.9-18.7	16.2	1.04	1.35
preorbital distance	6.4-8.8	7.5	0.66	6.8-9.1	7.7	0.55	1.34
postorbital distance	11.9-16.4	14.2	0.99	13.1-14.8	13.7	0.46	3.34**
horizontal eye diameter	5.0-8.7	6.7	0.34	5.7-7.4	6.4	0.47	2.54*
vertical eye diameter	5.0-9.0	6.8	0.41	5.9-7.0	6.4	0.33	4.44**
max. body depth	22.0-31.6	26.8	1.74	24.1-31.1	27.9	2.17	1.98
min. body depth	9.7-13.7	11.0	0.66	10.2-12.5	11.6	0.70	0.85
max. body width	14.4-25.0	17.6	1.53	15.6-18.8	17.2	0.82	1.59
max. body circumference	63.5-88.2	76.6	6.55	73.1-93.0	81.3	5.99	2.94**
antedorsal distance	53.7-67.4	61.5	2.03	59.2-64.7	61.7	1.41	0.50
postdorsal distance	26.1-41.8	30.9	2.14	25.1-41.9	30.6	3.97	0.30
anteventral distance	49.9-61.2	56.2	2.29	48.3-59.9	55.4	2.51	1.23
anteanal distance	67.0-76.8	70.5	2.10	68.1-73.8	69.5	1.75	2.11*
dorsal fin length	8.0-12.8	10.1	0.77	8.9-11.8	10.3	0.86	0.90
dorsal fin depth	13.1-19.5	15.9	1.16	11.7-17.2	14.6	1.48	3.44**
anal fin length	7.7-11.3	9.1	0.76	7.5-11.3	9.0	0.88	0.44
anal fin depth	9.5-15.5	12.1	1.10	9.4-14.3	11.2	1.30	2.69*
pectoral fin length	11.7-17.2	14.7	0.94	13.0-16.0	14.8	0.61	0.57
ventral fin length	9.6-14.3	11.8	0.78	10.3-13.1	12.0	0.76	1.00
P-V	21.8-33.4	28.9	1.80	26.8-32.2	28.9	1.71	0.00

V-A	16.3-21.3	20.0	2.66	16.6-20.2	18.4	0.97	4.48**
caudal fin length (U.lobe)	18.3-24.0	21.3	1.92	16.6-23.5	20.4	1.84	1.85
caudal fin length (L.lobe)	18.5-24.1	20.7	1.81	13.8-23.5	19.7	2.31	1.70
length of caudal peduncle	15.9-23.7	20.6	2.17	16.1-23.2	20.5	1.95	0.19
depth of caudal peduncle	10.1-14.3	13.0	0.80	13.3-15.5	14.4	0.64	8.0**
D							
horizontal eye diameter	17.8-30.6	24.1	2.14	21.1-26.5	23.8	2.08	0.55
vertical eye diameter	17.8-30.1	24.2	2.35	21.5-28.8	23.7	1.81	1.00
preorbital distance	21.3-33.3	24.1	2.06	25.7-37.4	28.6	2.98	5.98**
postorbital distance	44.8-67.1	50.8	3.65	47.5-63.0	50.9	3.62	0.11
head depth at neck	61.3-87.7	67.9	4.68	63.7-93.6	72.2	6.33	2.68*
head depth through eye	45.9-68.1	51.2	3.50	47.6-67.6	52.2	4.48	0.87
skull width	25.1-44.3	33.0	4.68	31.3-45.2	34.3	3.19	1.43
max. width of head	39.7-80.3	59.5	5.85	54.4-81.3	60.3	6.25	0.49
E							
horizontal eye diameter	50.0-97.4	74.7	8.89	57.7-82.8	69.8	7.00	2.55*
vertical eye diameter	49.1-104.9	75.2	9.77	59.8-75.0	69.2	4.48	2.78*
F							
horizontal eye diameter	69.9-126.1	90.4	11.66	68.8-96.5	84.0	8.16	2.74*
vertical eye diameter	57.7-126.7	90.9	12.29	64.9-96.4	83.4	8.00	3.26**
G							
horizontal eye diameter	33.3-64.5	48.2	5.55	39.4-53.3	46.9	4.22	1.11
vertical eye diameter	33.3-65.8	48.5	6.09	40.8-52.2	46.6	3.12	1.95
H							
min. body depth	34.6-51.3	41.0	3.28	38.4-45.6	41.6	2.07	1.00
J							
pectoral fin length	40.5-66.5	51.8	6.15	45.9-59.1	51.2	3.20	1.91
K							
ventral fin length	47.9-78.5	62.1	6.81	57.2-77.7	65.3	2.05	3.77**
L							
min. body depth	39.2-69.1	53.6	6.26	46.1-68.0	57.2	8.05	1.75
depth of caudal peduncle	52.8-82.8	63.4	6.10	60.4-89.7	70.7	7.72	3.70**
width of caudal peduncle	33.1-51.6	40.7	6.92	37.4-54.7	46.3	4.90	4.06**

PLANTS

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VASCULAR PLANTS OF THE SVJATOJ NOS ISTHMUS, LAKE BAIKAL

O.A. Anenchonov[1], M. Chytrý[2], I. Dobšíček[3] and P. Pešout[4]

[1]Institute of Biology, Buryat Scientific Center, Siberian Department of the Russian Academy of Sciences, Sach' janovoj 6, SU-670042 Ulan-Ude, Buryatia, Russian Federation.

[2]Department of Systematic Botany and Geobotany, Faculty of Science, Masaryk University, Kotlářská 2, CS-611 37 Brno, Czechoslovakia.

[3]Institute of Tropical and Subtropical Agriculture, Agricultural University, CS-165 21 Praha 6, Czechoslovakia.

[4]SCHKO Blaník, CS-257 62 Louňovice pod Blaníkem, Czechoslovakia.

Abstract: A list of vascular plants of the Svjatoj Nos isthmus is presented, based on the authors' fieldwork in 1987 and 1991 and published data. The list consists of 366 species, subspecies and hybrids belonging to 67 families, of which 6 taxa are considered to be endemic to the Baikal region, and 8 species are included in the Red Data Book of Buryatia.

Key-words: Lake Baikal, Svjatoj Nos isthmus, vascular plants, floristics.

Introduction

From the floristic point of view, the Baikal region is one of the best-known parts of Siberia. The first botanical publications from this region by G.W. Steller, I.G. Gmelin and I.G. Georgi date back to 1739, 1747-1759, and 1775, respectively (Galazij and Moložnikov 1982). The results of this period of research were summarized and supplemented with new data by Turczaninow (1842-1856, 1857) in his "Flora Baicalensi-dahurica" and its amendments. In the following decades, more florists worked in the region of Baikal Siberia, but their data were not summarized until the mid 20th century (Popov 1957-1959, Popov and Busik 1966). From these works the early period of research was finished. Since that time, data on the geographical distribution of plants are continuously added and floristic lists are updated in accordance with new taxonomical findings (e.g. Malyšev and Peškova 1979).

This work is a contribution to the regional flora of eastern Siberia. It is largely a result of the Czechoslovak expedition "Svjatoj Nos 1991", which worked in the region from June to September 1991, To some extent, the data collected by the senior author in August 1987 are included.

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Area under study

The area under study covers the Svjatoj Nos isthmus, including the coasts of Čivyrkujskij and Barguzinskij Bays in the north and the southwest, respectively, and the forest complexes in the northwest and southeast. A general description of the area was given by Mlíkovský et al. (1992). The floristic knowledge about the wetland area is very poor, perhaps due to difficult accessibility of the mires. Larin (1916) worked on the Svjatoj Nos peninsula territory, and some floristic data can also be found in Djagilev (1936). Additional data on the flora of the area under study were supplied by Popov and Busik (1966) and Sergilevskaja (1966, 1972). Some data can also be found in more recent publications on the Zabajkaľskij National Park.

Systematic list

In the following survey, the sequence of plant species and their nomenclature follow Malyšev and Peškova (1979). Of the published data, only those were used which unambiguously relate to the Svjatoj Nos isthmus. Data associated with a broad locality description only, such as "Svjatoj Nos peninsula" or "Čivyrkujskij Bay" were rejected. Similarly, only those data extracted from Russian literature which were accompanied by international scientific names were used, because the Russian vernacular nomenclature is not yet completely unified. Topological names used are taken from Mlíkovský et al. (1992). The abundance of species was classified according to the following scale:

[#1]. Species is dominant in many communities, and is widely distributed.
[#2]. Widely distributed, but usually not dominant.
[#3]. Patchily distributed.
[#4]. Rather rare, but may prevail at some sites.
[#5]. Rare, recorded from a maximum of 5 localities with thin populations.

Athyriaceae

Woodsia ilvensis (L.) R.Br.: Rocky slope of Kovrižka hill; rocks in the forest near Kulinoe [#5].

Aspidiaceae

Gymnocarpium dryopteris (L.) Newm.: Forest 1.5 km E of Glinka. [#5].

Thelypteridaceae

Thelypteris palustris (S.F. Gray) Schott: Mires 0.5 km N of Kordon. [#5].

Hypolepidaceae

Pteridium aquilinum (L.) Kuhn ex Decken: Pine forest and xerotherm pastures near Kulinoe. [#5].

Ophioglossaceae

Ophioglossum vulgatum L.: Lake Arangatuj (Popov and Busik 1966 sec. Djagilev 1936).

Polypodiaceac

Polypodium virginianum L.: Rocky slopes and the forest on Kovrižka hill. [#5].

Equisetaceae

Equisetum arvense L.: Mires, sands, wet forests. Mires O,5 km W of Kulinoe; near Samovo Lake; forest near Ełzicha. [#4].

E. fluviatile L.: Mires in the whole area. [#2].

E. hiemale L.: Sandy pine forests. Forest 1.5 km E of Glinka; forest near Ełzicha; forest near Barmašovye Lakes. [#4].

E. palustre L.: Mires on the Svjatoj Nos isthmus (Bojkov 1990). Mires. 1.5 km E of Glinka; SE margin of the forest near Ełzicha. [#3].

E. pratense Ehrh.: Forest near Ełzicha. [#5].

E. scirpoides Michaux: Peaty forest near Kulinoe. [#5].

E. sylvaticum L.: Peaty forests, wet forest margins. Forest margin O.5 km W of Kulinoe; peaty forest near Kordon. [#5].

E. variegatum Schleicher ex Weber et Mohr: Forest margin O.7 km W of Kulinoe. [#5].

Lycopodiaceae

Lycopodium annotinum L.: Forests. Near Kulinoe; near Kordon. [#3].

Diphasium complanatum (L.) Rothm.: Pine forests. Forests near Kulinoe and Elʹzicha. [#5].

Selaginellaceae

Selaginella rupestris (L.) Spring: Sunny rocky slopes, pine forests. Kovrižka hill; forest near Barmašovye Lakes. [#5].

Pinaceae

Abies sibirica Ledeb.: Wet forest margin near Kordon. [#5].

Larix gmelinii (Rupr.) Rupr.: Peaty forests. Forest on the bank of small lake near Kulinoe; forest patch within the mires near Samovo Lake. [#5].

L. sibirica Ledeb.: Forests, mire margins. Around Kulinoe; 1.5 km E of Glinka; forest N of Barmašovye Lakes. [#4].

Pinus pumila (Pallas) Regel: Malyj Čivyrkuj river bank 5 km from the mouth (Djagilev 1936). Forests, sands, bogs. Bogs around Kulinoe; 1.5 km E of Glinka; near Samovo Lake; forest near Elʹzicha; Kedrovka; Barguzinskij Bay coasts SE of Kedrovka. [#3].

P. sibirica Du Tour: Forests, sands. Near Kulinoe; forest near Elʹzicha; Kedrovka; Barguzinskij Bay coasts SE of Kedrovka. [#3].

P. sylvestris L.: Pine forest in the Svjatoj Nos isthmus (Bojkov 1990). Forests. NW, SW and S part of the isthmus outside the mires. [#1].

Typhaceae

Typha angustifolia L.: Lake Arangatuj (Popov and Busik 1966 sec. Djagilev 1936).

Sparganiaceae

Sparganium gramineum Georgi: In water: Čivyrkujskij Bay. [#4].

S. minimum Wallr.: Small lakes in mires in the whole area. [#3].

Potamogetonaceae

Potamogeton compressus L.: In small shallow lakes in the whole area. [#4].

P. crispus L.: In Lake Arangatuj (Sergievskaja 1966, Popov and Busik 1966 sec. Djagilev 1936).

P. gramineus L.: Disturbed lake banks. Along the road between Usť-Barguzin and Glinka. [#4].

P. lucens L.: Small lakes in mires in central and northern part of the area. [#5].

P. pectinatus L.: Barmašovye Lakes (Andreeva in Popov and Busik 1966). In water. Barmašovye Lakes. [#4].

P. perfoliatus L.: Deeper small lakes in mires. Central part of the area; Čivyrkujskij Bay coast. [#2].

P. praelongus Wulfen: In lake near Kulinoe. [#5].

P. pusillus L.: In small lakes. Along the road between Usť-Barguzin and Kedrovka. [#5].

P. vaginatus Turcz.: In Barmašovye Lakes (Sergievskaja 1966).

Juncaginaceae

Triglochin maritima L.: Mires. Around Kulinoe; around Kordon. [#4].

T. palustre L.: Mires near W margin of the Svjatoj Nos isthmus (Bojkov 1990). Grazing-influenced parts of mires. Between Kulinoe and Kovrižka hill; 0.5 km N of Samovo Lake; 1 km SE of Kedrovka; near Barmašovye Lakes. [#4].

Scheuchzeria palustris L.: Mires. 0.5 km W of Kulinoe; 0.5 km NW of Kordon. [#5].

Alismaceae

Sagittaria natans Pallas: In water. Samovo Lake; Čivyrkujskij Bay. [#4].

Poaceae

Setaria viridis (L.) Beauv.: Along the road between Usť-Barguzin and Monachovo. [#4].

Phalaroides arundinacea (L.) Rausch.: Lake Arangatuj (Malyšev in Popov and Busik 1966).

Phleum pratense L.: Mire margin near Kulinoe. [#5].

Alopecurus aequalis Sobol.: Pools along the roads. Near Kulinoe; along the road in NW part of the forest near Eľzicha; Kordon. [#4].

Agrostis clavata Trin.: Wet sands. Mire margins near Eľzicha; Kordon; shores of Barmašovye Lakes. [#4].

A. gigantea Roth: Pastures. Kovrižka hill foot. [#5].

A. mongholica Roshev.: Along the road between Usť-Barguzin and Monachovo. [#5].

A. trinii Turcz.: Xerotherm grass stands on Kovrižka hill. [#5].

Calamagrostis epigeios (L.) Roth: Sands, xerophilous forests. Barguzin Bay coasts; forest near Eľzicha. [#3].

C. neglecta (Ehrh.) Gaertner, Meyer et Schreber: Mires, mire margins, wet sands on the whole area. [#1].

C. obtusata Trin.: Larch and pine forests on the Svjatoj Nos isthmus (Bojkov 1990). Near Kulinoe; 2 km E of Glinka; forest near Barmašovye Lakes. [#4].

C. purpurea (Trin.) Trin. subsp. langsdorffii Link: Istok river bank, shores of Lake Arangatuj, Malyj Čivyrkuj river mouth (Djagilev 1936). Mires, mire margins, wet sands in the whole area. [#1].

Helictotrichon schellianum (Hackel) Kitag.: Xerotherm grass stand on the Kovrižka hill. [#5].

Beckmannia syzigachne (Steudel) Fern.: Mire margins, wet sands. Near Kulinoe; between Lake Arangatuj and Barguzinskij Bay coast; Kordon. [#4].

Phragmites australis (Cav.) Trin. ex Steudel: Barmašovye Lakes (Andreeva in Popov and Busik 1966). Mires around Kovrižka hill. [#3].

Koeleria cristata (L.) Pers.: Rocky slopes. Kovrižka hill. [#5].

Melica nutans L.: Larch forest on the Svjatoj Nos isthmus (Bojkov 1990).

Poa angustifolia L.: Xerotherm grass stands, sands, xerophilous pine forests. Kovrižka hill; 0.5 km NW of Samovo Lake; Kedrovka; 2 km S of Barmašovye Lakes. [#3].

P. attenuata Trin.: Xerophilous grassland on Kovrižka hill. [#5].

P. palustris L.: Mires on the Svjatoj nos isthmus (Bojkov 1990).

P. pratensis L.: Mire margin 1.5 km E of Glinka. [#5].

P. sibirica Roshev.: Larch forest on the Svjatoj Nos isthmus (Bojkov 1990). Hell forests, forest margins. 2 km E of Glinka; NW part of the forest near El'zicha. [#5].

P. supina Schrader: Along the road near El'zicha; tourist camp near Barmašovye Lakes. [#5].

P. transbaicalica Roshev.: Along the road in Kedrovka. [#5].

Scolochloa festucacea (Willd.) Link: Lake Arangatuj (Malyšev and Peškova 1979). Mires near the Kovrižka hill. [#5].

Glyceria spiculosa (Fr. Schmidt) Roshev.: Mires, peaty forests in the whole area. [#2].

Puccinelia tenuiflora (Griseb.) Scribner et Merr.: Habitats along the road near Barmašovye Lakes influenced by cattle grazing. [#5].

Festuca ovina L. s.l.: Sands, xerophilous pine forests. Kovrižka hill 1.5 km E of Glinka; around Samovo Lake; Kedrovka; Barguzinskij Bay coasts SE of Kedrovka; forests around Barmašovye Lakes. [#3]. The larger part of the populations in the area under study approximates by their characters to the endemic taxon of the shores of Baikal *Festuca ovina* subsp. *vylzaniae* E. Alexeev (cf. Malyšev and Peškova 1990).

F. rubra L.: Pine forest in the Svjatoj Nos isthmus (Bojkov 1990).

F. rubra L. subsp. *baicalensis* (Griseb.) Tzvelev: Sands on the Barguzinskij Bay coast. [#2].

Bromopsis inermis (Leysser) Holub: Sands. Čivyrkujskij Bay coast. [#5].

B. pumpelliana (Scribner) Holub: Sands. Kedrovka. [#5].

Elytrigia repens (L.) Nevski: Sands; road margins. Foot of Kovrižka hill; Kulinoe; 1.5 km E of Glinka; forest near Eľzicha; Kedrovka; forest near Barmašovye Lakes. [#3].

Agropyron cristatum (L.) Beauv.: Rocky slopes. Kovrižka hill. [#5].

Elymus sibiricus L.: Along the road 1 km S of Barmašovye Lakes. [#5].

Leymus secalinus (Georgi) Tzvelev: Sand on the Barguzinskij Bay coast. [#2].

Hordeum jubatum L.: Ruderal habitats. Along the road in Kedrovka; Kordon. [#5].

Cyperaceae

Eriophorum gracile Roth: Lake Arangatuj (Malyšev in Popov and Busik 1966). Mires in the whole area. [#3].

E. polystachyon L.: Malyj Čivyrkuj river bank 5 km of the mouth (Djagilev 1936 sub *E. angustifolium*); Malyj Čivyrkuj river near Lake Arangatuj (Popov and Busik 1966 sec. Djagilev 1936 sub *E. angustifolium*). Peaty forests. 1 km NW of Samovo Lake; near Barmašovye Lakes. [#5].

E. russeolum Fries: Mires, peaty forests in the whole area. [#3].

Baeothryon alpinum (L.) Egor.: Mire between Kordon and Lake Arangatuj. [#5].

Scirpus radicans Schkuhr: Lake Arangatuj (Sergievskaja 1972). Mires, margins of small lakes. Below Golaja Gora hill; Kedrovka; Barmašovye Lakes. [#4].

S. tabernaemontani C.C.Gmelin: Lake Arangatuj (Malyšev in Popov and Busik 1966). Mires between Kulinoe and Kovrižka hill. [#2].

Eleocharis austriaca Hayek: Wet sands near Barmašovye Lakes (cf. Bureš 1992). [#5].

E. klingei (Meinsh.) B. Fedtsch.: Mire margins. Kedrovka; near Kordon (cf. Bureš 1992).

E. mamillata Lindb. fil.: Mire margins. Near Kordon; between Kedrovka and Barmašovye Lakes. [#4].

E. palustris (L.) R.Br.: Coast of Barmašovye Lakes. [#5].

E. uniglumis (Link) Schultes: Barmašovye Lakes (Andreeva in Popov and Busik 1966).

Carex capitata L.: Peaty forest 1 km NW of Samovo Lake. [#5].

C. dioica L.: Mires. Around Kulinoe; around Kordon. [#4].

C. paralella (Laest.) Sommerf. subsp. redowskiana (C.A. Meyer) Egor.: Mire on the forest margin 0.5 km W of Kulinoe. [#5].

C. appropinquata Schum.: Malyj Arangatuj shore (Malyšev and Peškova in Popov and Busik 1966).

C. diandra Schrank: Mires in the whole area. [#2].

C. pseudocuraica Fr. Schmidt: Lake Arangatuj (Sergievskaja 1972).

C. chordorrhiza Ehrh.: Lake Arangatuj shore (Malyšev in Popov and Busik 1966). Mires. 0.5 km SW of Kedrovka; between Barmašovye Lakes and Barguzinskij Bay coast. [#5].

C. canescens L.: Near Lake Arangatuj (Malyšev and Peškova in Popov and Busik 1966, Sergievskaja 1972). Peaty forests, mire margins, mires in the whole area. [#2].

C. lasiocarpa Ehrh.: Lake Arangatuj (Malyšev in Popov and Busik 1966); near Lake Arangatuj (Malyšev in Popov and Busik 1966, Sergievskaja 1972); mires in the Svjatoj Nos isthmus (Bojkov 1990). Mires in the whole area. [#1].

C. rugulosa Kük.: Lake Arangatuj (Malyšev in Popov and Busik 1966, Sergievskaja 1972).

C. pseudocyperus L.: Margins of lakes. Samovo Lake. [#5].

C. rhynchophysa C.A.Meyer: Mire 1.5 km E of Glinka. [#5].

C. rostrata Stokes: Mires in the whole area. [#1].

C. vesicaria L. subsp. *vesicata* (Meinsh.) Egor.: Mires in the whole area. [#3].

C. falcata Turcz.: Near Lake Arangatuj (Sergievskaja 1972).

C. pediformis C.A.Meyer: Xerotherm grass stand on Kovrižka hill. [#5].

C. ericetorum Poll.: Xerophilous pine forests. Forest near Elʹzicha; forest near Barmašovye Lakes. [#4].

C. korshinskyi Kom.: Sands, xerophilous pine forests. Central part of the forest near Elʹzicha; Kedrovka; Kovrižka hill. [#4].

C. limosa L.: Near Lake Arangatuj (Malyšev and Peškova in Popov and Busik 1966); mires in the Svjatoj Nos isthmus (Bojkov 1990). Mires in the whole area. [#1].

C. meyerana Kunth: Lake Arangatuj (Malyšev in Popov and Busik 1966, Sergievskaja 1972). Mire margin in Kedrovka. [#5].

C. sabulosa Turcz. ex Kunth: Sands. SE half of the forest near Elʹzicha; Kedrovka. [#4].

C. acuta L.: Mires in the Svjatoj Nos isthmus (Bojkov 1990).

C. appendiculata (Trautv. et Meyer) Kük.: Mires, margins of mires, wet sands in the whole area. [#4].

C. caespitosa L.: Peaty forests, peaty forest margins. Forest margin 0.5 km E of Kulinoe; 2 km E of Glinka; forest near Kordon. [#4].

C. juncella (Fries) Th. Fries subsp. *wiluica* (Meinsh.) Egor.: Mires, margins of mires, wet sands in the whole area. [#3].

Araceae

Calla palustris L.: Mires, lake margins. Samovo Lake; Lake Arangatuj near Kordon. [#4].

Lemnaceae

Spirodella polyrrhiza (L.) Schleiden: In water. Mire near Kovrižka hill; Lake Arangatuj near Kordon. [#5].

Lemna minor L.: In water. Mire near Kovrižka hill; Čivyrkujskij Bay; Barmašovye Lakes. [#4].

L. trisulca L.: In small lakes in the whole area. [#3].

Juncaceae

Juncus alpino-articulatus Chaix: Wet sands. The forest near Elʹzicha. [#5].

J. bufonius L. s.l.: Wet sands. Along the road near Samovo Lake; forest near Elʹzicha; shore of Barmašovye Lakes. [#5].

J. filiformis L.: Wet sands, pastures. Kovrižka hill foot; SE part of the forest near Elʹzicha. [#5].

Luzula pallescens Sw.: Peaty forest near Kedrovka. [#5].

L. pilosa (L.) Willd.: Pine forest 1,5 km E of Glinka. [#5].

L. sibirica V. Krecz.: The forest near Elʹzicha. [#5].

Liliaceae

Allium splendens Willd. ex Schultes et Schultes f.: Xerotherm grass stands, sands. Kovrižka hill; along the road near Samovo Lake; Kedrovka. [#5].

Smilacina trifolia (L.) Desf.: Mires in the Svjatoj Nos isthmus (Bojkov 1990). Mires, peaty forests. Around Kulinoe; 1.5 km E of Glinka; around Samovo Lake; NW part of the forest near Elʹzicha; Kedrovka; around Kordon. [#3].

Maianthemum bifolium (L.) F.W. Schmidt: Larch forest in the Svjatoj Nos isthmus (Bojkov 1990). Forests, shrub stands. Kovrižka hill; forest near Elʹzicha; Kedrovka; forest near Barmašovye Lakes. [#3].

Polygonatum odoratum (Miller) Druce: Shrub stands. Kedrovka. [#5].

Paris hexaphylla Cham.: Forest near Kordon. [#5].

Iridaceae

Iris laevigata Fischer et Meyer: Mires. Near Samovo Lake; near Lake Arangatuj and Barguzinskij Bay coast; N of Kordon; around Barmašovye Lakes. [#4].

I. sanguinea L.: Lake Arangatuj shore (Popov and Busik 1966 sec. Larin 1916).

Orchidaceae

Hammarbya paludosa (L.) O. Kuntze: Mires near Kordon settlement. [#5].

Corallorhiza trifida Chatel: Forests, mires. Forest near Elʹzicha; mires near Kordon. [#5].

Spiranthes amoena (Bieb.) Sprengel: Mires 0.5 km W of Kulinoe. [#5].

Herminium monorchis (L.) R.Br.: Mires 0.5 km W of Kulinoe. [#5].

Dactylorhiza cruenta (O.F. Mueller) Soó: Mires in the whole area. [#4].

D. fuchsii (Druce) Soó: Forests. Forest near Elʹzicha; forest near Kordon. [#5].

D. incarnata (L.) Soó: Mires, peaty forests. In the whole area. [#4].

Salicaceae

Populus tremula L.: Forests. Kovrižka hill; between Barmašovye Lakes and entrance to the Park. [#4].

Salix caprea L.: Peaty forest near Kordon. [#5].

S. hastata L.: Mire 0.5 km E of Kulinoe. [#5].

S. krylovii E. Wolf: Peaty habitat in SE part of the forest near Elʹzicha. [#4].

S. myrtilloides L.: Lake Arangatuj (Malyšev in Popov and Busik 1966). Mires in the whole area. [#3].

S. pseudopentandra Floderus: Mires near Kedrovka. [#5].

S. rosmarinifolia L.: Mires. Around Kulinoe; 1.5 km E of Glinka; Kedrovka; between Lake Arangatuj and Barguzinskij Bay coast. [#3].

Betulaceae

Betula fruticosa Pallas: Mires near Kordon. [#4].

B. nana L. subsp. *exilis* (Sukaczev) Hulten: Malyj Čivyrkuj river mouth (Djagilev 1936); mires near Kultuk Bay (Djagilev 1936); mires in the Svjatoj Nos isthmus (Bojkov 1990).

B. nana L. subsp. *rotundifolia* (Spach) Malyschev: Mire 1,5 km E of Glinka. [#5].

B. pendula Roth: Fire influenced and peaty forests. In the whole area. [#3].

B. platyphylla Sukaczev: Forests, bogs in the whole area. [#3].

B. x *pseudomiddendorffii* V. Vassil.: Mires near Kulinoe. [#5].

Duschekia fruticosa (Rupr.) Pouzar: Forests. Around Kulinoe; 1.5 km E of Glinka; the forest near Eľzicha; around Barmašovye Lakes. [#3].

Urticaceae

Urtica cannabina L.: Pastures. Kulinoe. [#5].

U. dioica L.: Ruderal habitats. Around Kulinoe; along the road in Kedrovka. [#5].

Polygonaceae

Rumex acetosella L.: Sands, sandy forests. NW part of the forest near Eľzicha; forest near Barmašovye Lakes. [#5].

R. maritimus L.: Mires in the Svjatoj Nos isthmus (Bojkov 1990). Mires near Kordon. [#5].

R. protractus Rech.: Istok river bank (Djagilev 1936 sub *R. aquaticus*; Popov and Busik 1966 sec. Djagilev 1936); Shores of Lake Arangatuj (Djagilev 1936 sub *R. aquaticus*). Mires in the whole area. [#3].

Polygonum amphibium L.: Lakes. Čivyrkujskij Bay near Istok river mouth; Samovo Lake; between Barmašovye Lakes and Barguzinskij Bay coast. [#5].

P. angustifolium Pallas: Xerotherm grass stands, pastures. Kovrižka hill, Kulinoe. [#5].

P. aviculare L. s.l.: Along roads, pastures. Kulinoe; along the road between Usť-Barguzin and Monachovo; Kordon; tourist camp near southern Barmašovye Lakes. [#3].

P. baicalense Sipl.: Sands. Coast of the Barguzinskij Bay. [#3].

P. belophyllum Litv.: Lake Arangatuj shore near Kordon. [#4].

P. bistorta L.: Istok river shores and shores of Lake Arangatuj (Djagilev 1936). Mire margins. 0.5 km E of Kulinoe. [#5].

P. convolvulus L.: Along the road between Usť-Barguzin and Monachovo. [#5].

P. hydropiper L.: Margins of mires, coasts of small lakes. 1.5 km E of Glinka; Lake Arangatuj shore near Kordon; along the road 4 km N of Barmašovye Lakes. [#3].

P. lapathifolium L.: Margins of mires, coasts of small lakes. Kulinoe; 1.5 km E of Glinka; Kedrovka; near Barmašovye Lakes. [#3].

P. minus Hudson: Around hot springs, lake shores. Near Kulinoe; Barmašovye Lakes. [#5].

P. riparium Georgi: Kovrižka hill (Popov and Busik 1966). Sands in Kedrovka. [#5].

P. sericeum Pallas ex Georgi: Sands on the Barguzinskij Bay coast. [#3].

Chenopodiaceae

Chenopodium album L.: Along roads, ruderal habitats. Kovrižka hill; Kulinoe; near Samovo Lake; Kedrovka; along the road near Barmašovye Lakes. [#4].

C. aristatum L.: Along the road in Kedrovka. [#5].

C. glaucum L.: Grazing influenced wet habitats. Shore of Barmašovye Lakes. [#5].

Axyris amaranthoides L.: Along the roads, ruderal habitats. Near the entrance to the Park; along the road near Eľzicha. [#4].

Corispermum ulopterum Fenzl: Sands on the Barguzinskij Bay coasts. [#3].

Caryophyllaceae

Stellaria angarae M. Popov: Pastures. Kovrižka hill foot; Kulinoe. [#5].

S. dichotoma L.: Sands, rocky slopes. Kovrižka hill; Barguzinskij Bay coast. [#3].

S. longifolia Muehl. ex Willd.: Mires on the SE margin of the Eľzicha forest. [#5].

Cerastium arvense L.: Xerotherm grass stands on Kovrižka hill. [#5].

C. vulgatum L.: Along the road near Barmašovye Lakes. [#5].

Sagina procumbens L.: Wet sands. Margin of the forest near Eľzicha. [#5].

Moehringia laterifolia (L.) Fenzl: Forests. Kulinoe; 1.5 km E of Glinka; NW part of the Eľzicha; mires near Kordon; forest near Barmašovye Lakes. [#3].

Silene repens Patrin: Sands, xerotherm grass stands, sandy forests. Kovrižka hill; Kulinoe; Barguzinskij Bay coasts. [#3].

Lychnis sibirica L.: Kovrižka hill (Malyšev 1957). Xerotherm grass stands on Kovrižka hill. [#5].

Melandrium album (Miller) Garcke: Ruderal habitats. Kulinoe. [#5].

Dianthus versicolor Fischer ex Link: Sandy forests; xerotherm grass stands. Kovrižka hill; Barguzinskij Bay coasts; forest near Barmašovye Lakes. [#3].

Nymphaeaceae

Nymphaea tetragona Georgi: Small lakes. Samovo Lake; a pool between Barmašovye Lakes and Barguzinskij Bay coast. [#5].

Ceratophyllaceae

Ceratophyllum demersum L.: Lakes. Small lakes along the road between Usť-Barguzin and Kedrovka; Barmašovye Lakes. [#4].

Ranunculaceae

Caltha natans Pallas ex Georgi: Pool along the road near Kordon. [#5].

Delphinium grandiflorum L.: Xerotherm grass stands on Kovrižka hill. [#5].

Aconitum longiracemosum Worosch.: Peaty forest 0.5 km N of Kordon. [#5].

Pulsatilla patens (L.) Miller s.l.: Kovrižka hill (Popov and Malyšev in Popov and Busik 1966); larch forest in the Svjatoj Nos isthmus (Bojkov 1990). Sandy forests, xerotherm grass stands. Kovrižka hill; Kulinoe; forest near Eľzicha; forest near Barmašovye Lakes; forest near entrance to the Park. [#4].

Atragene sibirica L.: Forests. Kovrižka hill; near Samovo Lake. [#5].

Halerpestes salsuginosa (Pallas ex Georgi) Greene: Coasts of Barmašovye Lakes. [#5].

Batrachium circinatum (Sibth.) Spach: Small lakes. In NW part of the area; Samovo Lake. [#4].

Ranunculus gmelinii DC.: Small shallow lakes, pools, lake coasts in the whole area. [#3].

R. natans C.A. Meyer: Small lakes in mires between Kulinoe and Kovrižka hill. [#5].

R. propinquus C.A. Meyer: Pastures on Kovrižka hill foot. [#5].

R. repens L.: Grazing-influenced habitats. Near Barmašovye Lakes. [#5].

R. reptans L.: Small shallow lake banks, wet sandy places. Barguzinskij Bay coast; near Barmašovye Lakes. [#4].

R. sceleratus L.: Shore of the Barmašovye Lakes. [#5].

Thalictrum appendiculatum C.A. Meyer: Xerotherm grass stands on Kovrižka hill. [#5].

T. foetidum L.: Xerotherm grass stands on Kovrižka hill. [#5].

T. minus L.: Forest margin near Samovo Lake. [#5].

Papaveraceae

Chelidonium majus L.: Ruderal habitats. Forest on Kovrižka hill; along the road between Usť-Barguzin and Monachovo; N rocky slope of the Kovrižka hill. [#4].

Papaver ledebourianum Lundström: Sands on the Barguzinskij Bay coast. [#3].

P. nudicaule L.: Xerotherm grass stands on Kovrižka hill. [#5].

Brassicaceae

Descurainia sophia (L.) Webb ex Prantl: Ruderal habitats. Kulinoe; SE part of the forest near Eľzicha; along the road in Kedrovka. [#4].

Erysimum hieracifolium L.: Sands. Along the road near Samovo Lake; Kedrovka. [#5].

Rorippa palustris (L.) Besser: Lake Arangatuj (Peškova in Popov and Busik 1966). Margins of mires, wet sands. Kulinoe; Kedrovka; between Lake Arangatuj and Barguzinskij Bay coast; near Barmašovye Lakes. [#3].

Cardamine pratensis L.: Mires near Kordon. [#5].

Isatis oblongata DC.: Sands on the Barguzinskij Bay coast. [#3].

Draba nemorosa L.: Pastures, along the roads. Pastures near Kulinoe; along the road Usť-Barguzin - Monachovo; SE part of the forest near Eľzicha; near the entrance to the Park. [#4].

Brassica campestris L.: Ruderal habitats. Eľzicha. [#5].

Capsella bursa-pastoris L.: Along the roads. 1.5 km E of Glinka; near Eľzicha; Kordon. [#5].

Droseraceae

Drosera anglica L.: Mires, margins of mires. Mires 0.5 km W of Kulinoe; the forest near Eľzicha; 0.5 km N of Kordon. [#5].

D. rotundifolia L.: Mires near W margin of the Svjatoj Nos isthmus (Bojkov 1990). Mires, bogs. Around Kulinoe; 1.5 km E of Glinka; the forest near Eľzicha; around Kordon. [#4].

D. x *obovata* Mert. et Koch: Mires near Kordon. [#5].

Crassulaceae

Sedum aizoon L.: Xerotherm grass stands. Kovrižka hill. [#5].

S. maximum L. s.l.: Sunny rocky slopes. Kovrižka hill. [#5].

Orostachys spinosa (L.) C.A. Meyer: Rocky slopes. Kovrižka hill. [#5].

Saxifragaceae

Saxifraga hirculus L.: Mires near Kultuk Bay (Djagilev 1936); mires near W margin of the Svjatoj Nos isthmus (Bojkov 1990). Around Kulinoe; 2 km E of Glinka; around Kordon. [#4].

Mitella nuda L.: Pine forest near Kulinoe. [#5].

Parnassia palustris L.: Wet sites. Along the road near Barmašovye Lakes. [#5].

Ribes nigrum L.: Forest margin 0.5 km W of Kulinoe. [#5].

Rosaceae

Spiraea media Franz Schmidt: Pine forest in the Svjatoj Nos isthmus (Bojkov 1990). Forest margins, shrub stands. Forest on Kovrižka hill; central part of the forest near Eľzicha. [#5].

S. salicifolia L.: Mire margins, peaty forests in the whole area. [#2].

Cotoneaster melanocarpus Lodd.: Forests, shrub stands. Near Kulinoe; Barguzinskij Bay coast. [#3].

C. tjuliniae Pojark.: Forest on Kovrižka hill. [#5].

C. uniflorus Bunge: Forest on Kovrižka hill. [#5].

Sorbus sibirica Hedl.: Forests, shrub stands. Barguzinskij Bay coast. [#3].

Crataegus sanguinea Pallas: Sands, shrubs stands. Kedrovka. [#5].

Rubus arcticus L.: Peaty forest near Kordon. [#5].

R. chamaemorus L.: Malyj Čivyrkuj river bank 5 km of the mouth (Djagilev 1936). Bogs. Around Kulinoe; around Kordon. [#3].

R. humulifolius C.A. Meyer: Peaty forest near Kordon. [#5].

R. saxatilis L.: Forests. Kovrižka hill; 1.5 km E of Glinka. [#5].

Comarum palustre L.: Malyj Čivyrkuj river mouth (Djagilev 1936); mires in the Svjatoj Nos isthmus (Bojkov 1990). Mires in the whole area. [#2].

Potentilla acaulis L.: Rocky slopes, pastures. Kovrižka hill; Kulinoe. [#5].

P. acervata Soják: Pastures, sands. Kulinoe; Eľzicha. [#5].

P. anserina L.: Pastures, ruderal habitats. Kulinoe; shore of Barmašovye Lakes; Barguzinskij Bay shore near Barmašovye Lakes. [#4].

P. bifurca L.: Xerotherm grass stands, sands. Kovrižka hill; Kedrovka. [#5].

P. norvegica L.: Wet sands. Kulinoe; Eľzicha; Kedrovka. [#4].

P. tanacetifolia Willd. ex Schlecht.: Sparse forests. SE part of the forest near Eľzicha. [#5].

P. tergemina Soják: Along the road between Usť-Barguzin and Monachovo. [#4].

Geum allepicum Jacq.: Ruderal habitats. Around Kulinoe. [#5].

Filipendula ulmaria (L.) Maxim.: Mire margins under Golaja Gora hill. [#4].

Sanguisorba officinalis L.: Pastures, forests, mires. Kulinoe; Kedrovka; near Barmašovye Lakes; near the entrance to the Park. [#4].

Rosa acicularis Lindley: Larch and pine forests in the Svjatoj Nos isthmus. Sands, shrub stands, forests in the whole area. [#1].

Padus avium Miller: Sands on the Barguzinskij Bay coasts. [#3].

Fabaceae

Trifolium lupinaster L.: Forests, forest margins. Kovrižka hill; 1.5 km E of Glinka; NW part of the forest near Eľzicha; Kedrovka; near Barmašovye Lakes; near the entrance to the Park. [#4].

T. pratense L.: Ruderal habitats. Kovrižka hill foot; near Samovo Lake. [#5].

T. repens L.: Ruderal habitats. Along the road 1.5 km E of Glinka; near Samovo Lake; Kordon; tourist camp near Barmašovye Lakes; near the entrance to the Park. [#4].

Astragalus adsurgens Pallas: Larch forest in the Svjatoj Nos isthmus (Bojkov 1990).

A. fruticosus Pallas: Xerotherm grass stands on Kovrižka hill. [#5].

A. inopinatus Boriss.: Xerotherm grass stands, pastures. Kovrižka hill; Kulinoe. [#5].

A. norvegicus Weber: Grass stand 1.5 km E of Glinka. [#5].

Oxytropis lanata (Pallas) DC.: Sands. Barguzinskij Bay coasts. [#3].

Vicia cracca L.: Margins of forests, shrub stands. Forest margins near Kulinoe; near Samovo Lake; NW part of the forest near Eľzicha. [#5].

V. nervata Sipl.: Larch forest in the Svjatoj Nos isthmus (Bojkov 1990). Xerotherm grass stands, sands. Kovrižka hill; along the road in Kedrovka. [#4].

V. sepium L.: Forest margin 0.5 km W of Kulinoe. [#5].

Lathyrus pilosus Cham. Forest, scrub stands, mire margins. Near Kulinoe; near Samovo Lake; Kedrovka; forest near Kordon. [#5].

Geraniaceae

Geranium coeruleum Patrin: Xerotherm grass stands. Kovrižka hill. [#5].

G. pratense L.: Pastures. Kovrižka hill foot. [#5].

G. vlassovianum Fischer ex Link: Forest margin near Kulinoe. [#5].

Polygalaceae

Polygala hybrida DC.: Xerotherm grass stands. Kovrižka hill. [#5].

Callitrichaceae

Callitriche palustris L.: Small lakes in mires. Near Kulinoe; Barmašovye Lakes; small lake near Barguzinskij Bay coast near Barmašovye Lakes. [#4].

Empetraceae

Empetrum sibiricum V. Vassil.: Forests. 1.5 km E of Glinka; near Samovo Lake; forest near Eľzicha; Kedrovka; forest near Barmašovye Lakes. [#3].

Violaceae

Viola canina L.: Along the road near Kedrovka. [#5].

V. uniflora L.: Forests. Forest near Kulinoe; forest near the entrance to the Park. [#5].

Onagraceae

Chamaenerion angustifolium (L.) Scop.: In fire-influenced forests. Kovrižka hill; forest near Kulinoe; near Samovo Lake; forest near Eľzicha; Kedrovka; around Kordon; forest near Barmašovye Lakes. [#3].

Epilobium palustre L.: Mires near W margin of the Svjatoj Nos isthmus (Bojkov 1990). Mires in the whole area. [#2].

Haloragaceae

Myriophyllum spicatum L.: Small lakes. Kulinoe; near Barguzinskij Bay coast near Barmašovye Lakes. [#5].

M. verticillatum L.: In water. Samovo Lake. [#5].

Hippuridaceae

Hippuris vulgaris L.: Small lakes in mires. Between Lake Arangatuj and Barguzinskij Bay coast; Barmašovye Lakes. [#4].

Apiaceae

Bupleurum scorzonerifolium Willd.: Xerotherm grass stands. Kovrižka hill. [#5].

Cicuta virosa L.: Mires. Near Kovrižka hill; between Lake Arangatuj and Barguzinskij Bay coast; near Barmašovye Lakes. [#4].

Sium latifolium L.: Istok river bank and shores of Lake Arangatuj (Djagilev 1936); Lake Arangatuj banks (Popov and Busik 1966 sec. Djagilev 1936).

S. suave Walter: Mires near Golaja Gora hill [#5].

Phlojodicarpus baicalensis M. Popov: Sands. Barguzinskij Bay coast. [#3].

Peucedanum salinum Pallas: Mires. Around Kulinoe; Kedrovka; around Kordon. [#4].

Cornaceae

Swida alba (L.) Opiz: Sands. Barguzinskij Bay coast. [#4].

Pyrolaceae

Pyrola asarifolia Michaux: Forests. 0.5 km NW of Samovo Lake; near the entrance to the Park. [#5].

P. rotundifolia L.: Mires. 0.5 km W of Kulinoe; around Kordon. [#5].

Orthilia secunda (L.) House: Pine forests. NW part of the El'zicha forest. [#5].

Ericaceae

Ledum palustre L. subsp. *palustre*: Malyj Čivyrkuj river mouth (Djagilev 1936); Malyj Čivyrkuj river bank 5 km from the mouth (Djagilev 1936); Larch and pine forests and mires in the Svjatoj Nos isthmus. Forests, bogs on the whole area. [#2].

L. palustre L. subsp. *decumbens* (Aiton) Hultén: Bogs near Kulinoe. [#5].

Rhododendron dauricum L.: Larch forest on the Svjatoj Nos isthmus (Bojkov 1990). Forests on the whole area. [#3].

Andromeda polifolia L.: Lake Arangatuj (Popov and Busik sec. Larin 1916); mires near W margin of the Svjatoj Nos isthmus. Mires. Around Glinka; 1.5-2 km E of Glinka; around Kordon; near Barmašovye Lakes. [#4].

Chamaedaphne calyculata (L.) Moench: Malyj Čivyrkuj river bank 5 km from the mouth (Djagilev 1936); Mires on the Svjatoj Nos isthmus (Bojkov 1990). Mires, bogs on the whole area. [#3].

Arctostaphylos uva-ursi (L.) Sprengel: Larch forest on the Svjatoj Nos isthmus (Bojkov 1990). Sandy forests, shrub stands. Forest NW of Samovo Lake; forest near Eľzicha; Kedrovka; forest near Barmašovye Lakes. [#3].

Vacciniaceae

Vaccinium uliginosum L.: Malyj Čivyrkuj river bank 5 km from the mouth (Djagilev 1936); mires on the Svjatoj Nos isthmus (Bojkov 1990). Peaty forests, margins of mires, bogs in the whole area. [#3].

Rhodococcum vitis-idaea (L.) Avrorin: Larch forest on the Svjatoj Nos isthmus (Bojkov 1990). Forests, shrub stands in the whole area. [#3].

Oxycoccus microcarpus Turcz. ex Rupr.: Malyj Čivyrkuj river mouth, Malyj Čivyrkuj river bank 5 km of the mouth (Djagilev 1936); Lake Arangatuj (Popov and Busik 1966). Mires, bogs. Around Kulinoe; around Kordon. [#4].

O. palustris Pers.: Mires, bogs. Mires on the Svjatoj Nos isthmus (Bojkov 1990). Mires, bogs. Around Kulinoe; 2 km E of Glinka; around Kordon. [#4].

Primulaceae

Androsace lactiflora Fischer ex Duby: Sands in Kedrovka. [#5].

Naumburgia thyrsiflora (L.) Reichb.: Mires on the whole area. [#3].

Trientalis europaea L.: Forests. Kovrižka hill; forest near Eľzicha; Kedrovka. [#4].

Menyanthaceae

Menyanthes trifoliata L.: Istok river bank and shores of Lake Arangatuj (Djagilev 1936); Malyj Čivyrkuj river mouth (Djagilev 1936, Popov and Busik 1966 sec. Djagilev 1936); Lake Arangatuj (Popov and Busik 1966 sec. Djagilev 1936); mires on the Svjatoj Nos isthmus (Bojkov 1990). Mires on the whole area. [#2].

Nymphoides peltatum (S.G. Gmelin) O. Kuntze: Istok river (Djagilev 1936); Lake Arangatuj (Novokšonov in Popov and Busik 1966).

Polemoniaceae

Polemonium coeruleum L.: Lake Arangatuj (Peškova in Popov and Busik 1966).

Gentianaceae

Gentiana barbata Froel: Forest margins near Samovo Lake. [#5].

G. triflora Pallas: Forest margins near Samovo Lake. [#5].

Boraginaceae

Myosotis caespitosa K.F. Schultz: Wet pasture on Kovrižka hill foot. [#5].

M. scorpioides L. var. *nemorosa* (Besser) M. Ivanova: Sandy shore of the Barmašovye Lakes. [#5].

Lappula myosotis Moench: Sands on the Barguzinskij Bay coasts. [#5].

L. redowskii (Hornem.) Greene: Along the road in Kedrovka. [#5].

Amblynotus rupestris (Pallas ex Georgi) M. Popov ex Serg.: Kovrižka hill (Malyšev 1957).

Craniospermum subvillosum Lehm.: Sandy coasts of Barguzinskij Bay. [#4].

Lamiaceae

Schizonepeta multifida (L.) Briq.: Xerotherm grass stands. Kovrižka hill. [#5].

Dracocephalum nutans L.: Sands. SW part of the forest near Eľzicha. [#5].

Phlomis tuberosa L.: Pastures. Kovrižka hill; Kulinoe. [#5].

Galeopsis bifida Boenn.: Ruderal habitats. Near Golaja Gora hill; Kovrižka hill; along the road near Samovo Lake. [#5].

Lamium album L.: Pastures, ruderal habitats. Kovrižka hill foot; along the road between Usť-Barguzin town and Kedrovka. [#5].

Stachys aspera Michaux: Margins of mires. SE part of the forest near Eľzicha; Kedrovka; around Kordon. [#5].

Thymus baicalensis Serg. s.l.: Xerotherm grass stands. Kovrižka hill. [#5].

Scrophulariaceae

Linaria acutiloba Fischer ex Reichenb.: Sands in Kedrovka. [#5].

L. vulgaris Miller: Pastures. Kovrižka hill foot; Kulinoe. [#5].

Scrophularia incisa Weinm.: Sandy coasts of Barguzinskij Bay. [#3].

Veronica incana L.: Xerotherm grass stands. Kovrižka hill. [#5].

V. longifolia L.: Pasture at Kovrižka hill foot. [#5].

Euphrasia stricta D. Wolff ex J.F. Lehm.: Forest margins, pastures. Kulinoe; around Samovo Lake; the forest near Eľzicha; forest near Barmašovye Lakes. [#4].

Rhinanthus angustifolius C.C. Gmelin: Pastures, path margins, forest margins. Kulinoe; NW part of the forest near Eľzicha; Kedrovka; forest near Barmašovye Lakes; near the entrance to the Park. [#4].

Pedicularis karoi Freyn: Mires. Near Kulinoe; 1.5 km E of Glinka; Kedrovka; near Kordon. [#5].

P. labradorica Wiesing: Forests. NW part of the forest near Elʹzicha; around Kordon; near Barmašovye Lakes. [#5].

P. resupinata L.: Forests. Forest near Elʹzicha; forest near Kordon. [#5].

Orobanchaceae

Orobanche coerulescens Stephan: Xerotherm grass stands. Kovrižka hill. [#5].

Lentiburinaceae

Utricularia intermedia Hayne: Mires in the whole area. [#2].

U. minor L. Malyj Čivyrkuj river mouth (Djagilev 1936, Popov and Busik 1966 sec. Djagilev 1936).

U. vulgaris L.: Small lakes in mires. 2 km E of Glinka; near Kulinoe; mires near Kedrovka; small lakes in mires near Barmašovye Lakes. [#3].

Plantaginaceae

Plantago major L.: Pastures. Kovrižka hill; Kulinoe; margin of the forest near Elʹzicha; Kordon; tourist camp near Barmašovye Lakes; near the entrance to the Park. [#4].

P. media L.: Pastures. Kulinoe; 1.5 km E of Glinka. [#5].

P. depressa Willd.: Disturbed wet habitats. Near the entrance to the Park; near Barmašovye Lakes. [#4].

Rubiaceae

Galium boreale L.: Forests, forest margins. Around Samovo Lake. [#5].

G. trifidum L.: Mires. Around Kovrižka hill; Lake Arangatuj shores near Kordon. [#5].

G. uliginosum L.: Mires. Between Kulinoe and Kovrižka hill; near Kordon. [#4].

G. verum L.: Xerotherm grass stands, forest margins. Kovrižka hill; NW part of the forest near Elʹzicha. [#5].

Caprifoliaceae

Linnaea borealis L.: Forests. NW part of the forest near Elʹzicha; near Kordon. [#4].

Valerianaceae

Valeriana transjenisensis Kreyer: Forest on Kovrižka hill. [#5].

Campanulaceae

Campanula glomerata L.: Xerotherm grass stands. Kovrižka hill. [#5].

C. rotundifolia L. s.l.: Xerophilous pine forests. Forest near Eľzicha; forest near Barmašovye Lakes. [#5].

Asteraceae

Solidago dahurica Kitag.: Forests, forest margins. Kovrižka hill; 1.5 km E of Glinka. [#5].

Heteropappus altaicus (Willd.) Novopokr.: Kovrižka hill (Malyšev 1957). Xerotherm grass stands. Kovrižka hill. [#4].

H. tataricus (Lindley) Tamamsch.: Xerotherm grass stands. Kovrižka hill foot. [#5].

Aster serpentimontanus Tamamsch.: Kovrižka hill (Popov and Busik 1966 sub A. alpinus). Xerotherm grass stands. Kovrižka hill. [#5].

Galatella dahurica DC.: Xerotherm grass communities. Kovrižka hill. [#5].

Erigeron acer L.: Ruderal habitats. Along the road near Samovo Lake. [#5].

Antennaria dioica (L.) Gaertner: Xerophilous forests. Central part of the forest near Eľzicha; Kedrovka; near Barmašovye Lakes; near the entrance to the Park. [#4].

Inula britannica L.: Wet sands. Kedrovka. [#5].

Bidens cernua L.: Lake Arangatuj shores near Kordon. [#4].

B. radiata Thuill.: Margins of mires. Between Kulinoe and Kovrižka hill; near Kordon. [#5].

Achillea asiatica Serg.: Forest margins, mire margins, along the roads, pastures. In the whole area. [#3].

Leucanthemum vulgare Lam.: Grassy habitats along the roads. 1.5 km E of Glinka; around Samovo Lake. [#5].

Matricaria discoidea DC.: Trampled habitats. Near Eľzicha; along the road in Kedrovka; tourist camp near Barmašovye Lakes. [#5].

Dendranthemum zawadskii (Herb.) Tzvelev: Forests, forest margins. 1.5 km E of Glinka; around Samovo Lake; central and N part of the forest near Eľzicha; forest near Barmašovye Lakes. [#4].

Artemisia bargusinensis Sprengel: Kovrižka hill (Popov and Busik 1966 sec. Malyšev 1957).

A. commutata Besser: Xerotherm grass stands, sands. Kovrižka hill; Kedrovka. [#5].

A. frigida Willd.: Xerotherm grass stands. Kovrižka hill. [#5].

A. mongolica (Besser) Fischer ex Nakai: Ruderal habitats. Along the road in Kedrovka; Kordon. [#5].

A. sericea Weber ex Stechm.: Xerotherm grass stands, sunny rocks. Kovrižka hill. [#5].

A. tanacetifolia L.: Xerotherm grass stands, forests. Kovrižka hill; central part of the forest near Eľzicha. [#5].

A. vulgaris L.: Ruderal habitats. Pastures near Kulinoe; margin of the forest near Eľzicha. [#4].

Senecio congestus (R.Br.) DC.: Mires. Between Kulinoe and Kovrižka hill; between Lake Arangatuj and Barguzinskij Bay coasts; near Barmašovye Lakes. [#4].

Scorzonera radiata Fischer: Xerotherm grass stands, forests. Kovrižka hill, forest near Barmašovye Lakes. [#5].

Achyrophorus maculatus (L.) Scop.: Xerotherm grass stands. Kovrižka hill. [#5].

Lactuca sibirica (L.) Bentham ex Maxim.: Shrub stands, along the roads. Kovrižka hill foot; along the road near Samovo Lake; Kedrovka; Kordon; forest near Barmašovye Lakes. [#4].

Youngia tenuifolia (Willd.) Babc. et Stebbins: Kovrižka hill (Popov and Busik 1966 sec. Malyšev 1957).

Taraxacum ceratophorum (Ledeb.) DC.: Xerotherm grass stands. Kovrižka hill. [#5].

Crepis tectorum L.: Rocky slopes, sands. Kovrižka hill; along the road 1 km SE of Eľzicha. [#5].

Hieracium ganeschinii Zahn: Sparse forests. The forest near Eľzicha. [#5].

H. umbellatum L.: Xerophilous forests, scrub stands, sands. Kovrižka hill; NW part of the forest near Eľzicha; Kedrovka; forests around Barmašovye Lakes; near the entrance to the Park. [#4].

Summary

The floristic survey of the Svjatoj Nos isthmus contains 366 species, subspecies and hybrids of vascular plants, belonging to 67 families. The taxa considered to be endemic for the Baikal region are the following: *Corispermum ulopterum*, *Craniospermum subvillosum*, *Festuca rubra* subsp. *baicalensis*, *Phlojodicarpus baicalensis*, *Polygonum baicalense*, and the taxa from the *Thymus baicalensis* group. The following species are listed in the Red Data Book of Buryatia (Pronin 1988): *Corispermum ulopterum*, *Craniospermum subvillosum*, *Iris laevigata*, *Lilium martagon*,

Nymphaea tetragona, *Padus avium*, *Rhododendron dauricum*, and *Thelypteris palustris*. The presence of these species underlines the importance of protection of the area in the framework of the Zabajkaľskij National Park.

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COMMENTS ON THE GENUS *ELEOCHARIS* (CYPERACEAE) FROM THE SVJATOJ NOS ISTHMUS, LAKE BAIKAL

P. Bureš

Department of Systematic Botany and Geobotany, Faculty of Science, Masaryk University, Kotlářská 2, CS-611 37 Brno, Czechoslovakia.

Abstract: Taxonomical and phytogeographical comments on four species of *Eleocharis*, sect. *Eleocharis*, collected by the Svjatoj Nos 1991 expedition in the form of herbarium material were made.

Key-words: Lake Baikal, Svjatoj Nos isthmus, Cyperaceae, *Eleocharis*, taxonomy, distribution.

Introduction

Botanical research carried out in the frame of the Czechoslovak expedition "Svjatoj Nos 1991", held in June to September 1991, resulted in a description of flora (Anenchonov et al. 1992) and plant communities (Chytrý and Pešout 1992) of the Svjatoj Nos isthmus. During the expedition, numerous herbarium specimens were collected, which included some taxa interesting from the taxonomical, nomenclatural, and/or phytogeographical points of view. In the present paper, comments on *Eleocharis* sect. *Eleocharis* are presented. The herbarium material of the discussed taxa is deposited in the BRNU herbarium.

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Results

Eleocharis R. Br., sect. *Eleocharis* (Cyperaceae) is a complicated group, whose determination and classification is possible only on the basis of -- mostly quantitative -- micromorphological and anatomical characters. From the material collected by M.Chytrý and P.Pešout on the Svjatoj Nos isthmus at the eastern shore of Lake Baikal it was possible to identify the following taxa of this group:

Eleocharis austriaca Hayek

This species belongs to the group of *E. mamillata* Lindb. fil. s.l., which in the flora of the Russian Federation is represented by three taxa: *E. mamillata* subsp. *mamillata*, *E. m.* subsp. *ussurensis* (Zinserl.) Egor. and *E. austriaca*. In the Baikal region and the Far East, the most common taxon of this group is *E. m.* subsp. *ussurensis* (Egorova 1980, 1981, Bubnova 1986, 1990), which differs from *E. austriaca* especially in the proportions of stylopodium, the relation of its height to its breadth being 1:1 in *E. m. ussurensis*, and 1:2 in *E. austriaca*. The plants collected in the Far East under the name *E. leptostylopodiata* Zinserl. (= *E. austriaca* Hayek sensu Strandhede 1966) were identified by Egorova (1980, 1981) as *E. m.* subsp. *ussurensis*.

The easternmost localities of *E. austriaca* known thus far were then in the mountains of Gornyj Altaj and Kuzneckij Alatau and their neighboring highlands, i.e. approximately at 90° E (Egorova 1981, Bubnova 1986, 1990). The geographic location of the new discovery is approximately 109° E and 53° 30' N, i.e. about 1,100 km east of the above-mentioned localities.

Eleocharis mamillata Lindb. fil. subsp. *mamillata*

The herbarium specimens of this species collected on the Svjatoj Nos isthmus are interesting in having single basal amplexicaul glume with low (max. 30) number of fruits in the spike.

Bubnova (1986, 1990) remarked that when she studied the herbarium material from Siberia she very often saw plants identified as *E. m.* subsp. *mamillata*, which, according to her opinion, belonged to *E. sareptana* Zinserl. According to Bubnova (1986, 1990), *E. sareptana* is characterized particularly by a single sterile basal amplexicaul glume in the spike, 20-40 fruits in the spike and reticulate surface of the achene, while *E. m.* subsp. *mamillata* by two basal sterile glumes, and 40-70 fruits in the spike. According to these characters it would be possible to identify the plants from Lake Baikal as *E. sareptana*.

On the basis of Strandhede' s (1966) detailed morphological restudy of Zinserling' s type material of *E. sareptana*, it is clear that *E. sareptana* is identical to *E. uniglumis* (Link) Schult. subsp. *uniglumis*. Bubnova (1986, 1990) claimed that *E. sareptana* is a separate species, differing from *E. uniglumis* in the size and shape of stylopodium (see Tab. 1). *E. uniglumis* differs from *E. mamillata* group by a whole range of qualitative and quantitative characters, especially by the chromosome number (*E. mamillata* s.l. has 2n=16, *E. uniglumis* s.l. has 2n=46,74-82), which is in relation with many quantitative morphological characters (size of stomata, pollen, achene and theca; see Tab. 1), and with quantitative characters in the anatomy of the culm (cf. Walters 1953, Strandhede 1966). On the other hand, the groups overlap considerably in some quantitative characters, which in both groups show considerable variability (size and shape of stylopodium, number of sterile basal glumes; see Tab. 1). On the basis of the study of Czechoslovak material it is possible to state that the number of flowers or fruits in the spike is very variable. The evaluation of the sessiling of the stylopodium and achene surface is very subjective (cf. Fig. 2 in Bubnova 1986, Fig. 11c and 11d in Strandhede 1966, Fig. 4 in Walters 1953). Unfortunately, Bubnova (1986, 1990) defined the species *E. sareptana* solely on such characters.

The plants of the Baikal region belong to *E. mamillata* subsp. *mamillata*, which is, in addition to the characters listed in Tab. 1, confirmed also by the anatomical structure of the culm (collenchyma strands weak and few, single layers of palisade parenchyma cells between 11-12 vascular bundles resulting in a semi-translucent appearance of the culms), and bristles longer than the achenes. Zinserling (1935) listed bristles longer than the achenes as a characteristic; Bubnova 1986, 1990 gives for *E. sareptana* bristles shorter or as long as the achenes. *E. mamillata* subsp. *mamillata* is distributed over all the Eurasian temperate zone, and is considered rare in Siberia and the Far East (Egorova 1980, 1981, Bubnova 1986, 1990, Koževnikov 1988).

Table 1. Comparison of the variability of *Eleocharis mamillata* Lindb. fil. from Baikal with literary data.

	E. mamillata s.s. Baikal[1]	*E. mamillata* s.s. Europe[2]	*E. uniglumis* s.l. Europe[2]	*E.sareptana* Siberia[3]
Stomatal length µm	38-51	(38)42-52(65)	(40)50-63(76)	-
Basal glumes	1	2 or 1	1	1
Length of thecae mm	1.3-1.7	< 1.8	> 1.9	-
Pollen length µm	30-44	29-42	(36)39-62(70)	-
Pollen width µm	22-36	25-37	(26)31-40(45)	-
Achene length mm	1.2-1.3	1.2-1.5	1.1-2.0	-
Achene surface	± reticulate	± smooth	± reticulate	reticulate
Receptacle density cm^{-1}	ca 30-40	(30)36-48(56)	-	-
Number of fruits	< 30	-[4]	-	20-40
Stylopodium length mm	0.3-0.4	0.3-0.5(0.6)	(0.3)0.4-0.7(0.9)	0.3-0.5
Stylopodium width	0.6-0.8	(0.4)0.5-0.7(0.8)	0.5-1.0	0.7-0.9

1) This paper.
2) After Strandhede and Dahlgren (1968).
3) After Bubnova (1986).
4) 40-70 recommended by Bubnova (1986) from Siberia.

Eleocharis uniglumis (Link) Schultes

(incl. *E. klingei* (Meinsh) B. Fetsch.)

The plants collected in the Svjatoj Nos isthmus are morphologically somewhat different from the typical *E. uniglumis*. They are characterized by thicker culm, a larger number of fruits in the spike and lighter color of glumes. Egorova (1980, 1981) considered these types to be *E. klingei* (cf. Walters 1980). They most resemble intermediate types between *E. uniglumis* and *E. vulgaris*, known from Europe. *E. klingei* was mentioned from Siberia for the first time by Bubnova (1986, 1990). However, she did not list the proper *E. uniglumis* as occurring there (cf. Egorova 1980, 1981, Koževnikov 1988). Typical *E. uniglumis* was collected at Lake Baikal, e.g. from the Ol'chon island (Vašák 1969 BRA).

Eleocharis cf. *vulgaris* (S.M.Walters) Á.Löve, D.Löve et Sušnik

(*Eleocharis palustris* (L.) Roem. et Schult. cf. subsp. *vulgaris* S.M.Walters)

It is impossible to refer the plants collected at Lake Baikal on the basis of the anatomical structure of the skin, number of vascular bundles, stylopodium shape and by two basal sterile glumes to the group *E. palustris* s.l. The length of fertile glumes (more than 3.5 mm), receptacle density (ca. 30-40 fruits/cm), length of stomata (57-68 µm), and pollen length (more than 45 µm), however, fully corresponds with the variability, shown in Europe by *E. vulgaris*. The latter taxon is distributed only in Europe according to Walters (1980) and Egorova (1981). According to Strandhede (1966), *E. vulgaris* is a product of hybridization between *E. palustris* and *E. uniglumis*. These two species share large parts of their area, covering almost the entire Holarctic. It is thus possible to accept hypothetically the polytopic hybridogenic origin of *E. vulgaris*. The problem requires further, particularly karyological, study.

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PLANT COMMUNITIES OF THE SVJATOJ NOS ISTHMUS, LAKE BAIKAL

M. Chytrý[1], P. Pešout[2]
[1]Department of Systematic Botany and Geobotany, Faculty of Science, Masaryk University, Kotlářská 2, CS-611 37 Brno, Czechoslovakia.
[2]SCHKO Blaník, CS-257 62 Louňovice pod Blaníkem, Czechoslovakia.

Abstract: The vegetation of the Svjatoj Nos isthmus (eastern coast of Lake Baikal) was characterized according to the Braun-Blanquet approach. 16 water communities, 7 coastal communities, 5 mire and bog communities, 5 sand and steppe communities, 5 forest communities, and 5 ruderal and subruderal communities were distinguished. These communities are supported by synthetical tables. Vegetation patterns along environmental gradients as well as the main succession trends are briefly described on the basis of visual observations.

Key-words: Lake Baikal, Svjatoj Nos isthmus, plant communities, Braun-Blanquet approach

Introduction

The vegetation classification in the (former) USSR has been based mostly on the classical methods of the so-called dominant approach. Using these methods, a great amount of valuable material of descriptive character was collected. From central and eastern Siberia some significant monographs on particular vegetation types (Malyšev 1960, Pobedinskij 1965, Peškova 1972, Moložnikov 1975) and on plant communities (e.g. Ivanova 1969, Tjulina 1976, 1981) were published. Attempts at a synthesis of the accumulated data were presented by Peškova (1985) and Moložnikov (1986). In the 1980s, the Braun-Blanquet approach began to be used in the USSR (cf. Korotkov et al. 1991), including central and eastern Siberia (Guinochet 1982, Žitluchina 1986, 1988, 1989, Tužilin 1990). The present paper intends to contribute to our knowledge of the east Siberian vegetation. The field work was carried out in June-August 1991 during the "Svjatoj Nos 1991" expedition.

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The area of research

The research was carried out on the Svjatoj Nos isthmus on the eastern shore of Lake Baikal. The isthmus is formed from sandy sediments, and from the major part water-logged. A general description of the area was given by Mlíkovský et al. (1992).

The vegetation of the area has not been investigated in detail yet, and only general descriptions of some communities, without proper analyses of their composition, have been published thus far (Djagilev 1936, Bojkov 1990). Moložnikov (1974) presented a generalized map of the vegetation of the Svjatoj Nos peninsula. Only five categories, recognized by the dominant approach, were discerned there. Moložnikov (1986) added verbal descriptions of several communities and published a list of dominant species of different layers.

Methods

For the vegetation description classical methods of the Zürich-Montpellier approach (Braun-Blanquet 1964, Westhoff and van der Maarel 1978) were used. Relevés were taken in the field using a 7-degree scale of abundance and dominance (-,+,1,2,3,4,5). The term "community" is used here in the sense of a syntaxonomical unit corresponding to an association. The valid description of syntaxa in the sense of the Code (Barkman et al. 1986) will be published in a separate syntaxonomical study.

Phytosociological relevés are summarized in Appendices 1-6, in which numbers mean percentage constancy and figures in parentheses represent the grade of abundance and dominance. The numbers of synthetical relevés in the tables agree with the numbers of communities in the text. Names of vascular plants are taken from Malyšev and Peškova (1979, see also Anenchonov et al. 1992), the nomenclature of lichens and mosses follows Santesson (1984) and Frahm and Frey (1983), respectively.

Survey of plant communities

Water vegetation (Appendix 1)

1. *Lemna trisulca* community (Lemnetum trisulcae Soó 1927): The community of *Lemna trisulca*, floating generally in whole water profile. The optimum occurrence is in the water depth of 1-150(-200) cm. The community often covers large areas and is more common in eutrophicated

waters. It seems to suppress the following community. Widespread in the whole area.

2. *Lemna minor* community (Lemnetum minoris Th. Müller et Görs 1960): The water-surface community in wind-protected places, usually consisting of a monocenosis of *Lemna minor*. It is distributed in small patches. In the area under study it is less frequent than the previous and the following communities.

3. *Lemna-Spirodella polyrhiza* community (Lemno-Spirodelletum Koch 1954): The community of mostly floating plants, rooting in water. It prefers eutrophicated sites in wind-protected places. Pure phytocenoses of *Spirodella polyrhiza* were not found. The community occurs in smaller areas near Lake Arangatuj and Čivyrkujskij Bay.

4. *Lemna-Utricularia vulgaris* community (Lemno-Utricularietum vulgaris Soó 1928): The community of slightly submerged plants. The stand consists mostly of *Utricularia vulgaris* with scattered *Lemna trisulca* and surface-floating *Lemna minor*. It occurs in wind-protected places, and has never been observed on large open water surfaces. The community occurs mostly in small lakes among sedge tufts terrestrializating larger water areas. The optimum conditions of occurrence are in water depths of 20-30 cm. The community was found near Barmašovye Lakes.

5. *Ceratophyllum demersum* community (Ceratophylletum demersi [Soó 1928] Eggler 1933): Nearly monocenotic stands forming the community were found mostly on the margins of terrestrialized lakes, particularly in sites more frequently grazed by cattle. On some places, *Lemna trisulca* occurs in the community in addition to the dominant *Ceratophyllum demersum*. The optimum depth of water is approximately 60 cm. The community was found in Barmašovye Lakes.

6. *Myriophyllum verticillatum-Nymphaea tetragona* community: The community of aerohydatophytes and euhydatophytes in clean deeper waters (40-300 cm). The surface-coverage is relatively low (about 50%). The dominant species are *Nymphaea tetragona* and *Myriophyllum verticillatum*. *Sparganium gramineum* and *Potamogeton perfoliatus* may also occur, particularly in deeper waters. Deep under water surface in the tangle of stems and leaf petioles *Lemna trisulca* occurs. The community is present especially in Čivyrkujskij Bay, in its enriched form it was observed in Samovo Lake.

7. *Polygonum amphibium* community (Polygonetum amphibii Soó 1927): The community with small number of species, of which *Polygonum amphibium* is dominant. At the stem bases *Lemna trisulca* regularly occurs, less common is the occurrence of *Sparganium gramineum*,

Potamogeton perfoliatus etc. The community occurs in the sites with water 100-250 cm deep on large areas in the Čivyrkujskij Bay.

8. *Sparganium gramineum* community: The community of floating plants with dominant *Sparganium gramineum. Lemna trisulca, Potamogeton perfoliatus* and *Nymphaea tetragona*, among others, may occur with low coverage. The community inhabits deep waters (100-300 cm), and resists strong waves. It was found on large areas in the Čivyrkujskij Bay.

9. *Potamogeton gramineus* community (Potametum graminei Koch 1926): Invading community, which occurs particularly on disturbed lake shores. It is distributed throughout the water column profile with the coverage of 100%. The dominant position is held by *Potamogeton gramineus* and *Lemna trisulca*, sometimes by *Callitriche palustris* and *Potamogeton pusillus*. The community often contains *Ceratophyllum demersum* and Lemna minor. The optimum water depth for its presence is 20-30 cm. It occurs on the disturbed lake shores near the road along the Barguzinskij Bay.

10. *Potamogeton lucens* community (Potametum lucentis Hueck 1931): The submerged-plant community in waters of various depth (30-150 cm). In its most typical form it is developed in deeper water, where *Potamogeton lucens* is accompanied only by *Potamogeton pusillus*. In shallower water other species may also occur, such as *Batrachium circinatum, Myriophyllum verticillatum, Callitriche palustris* etc. However, the latter species mostly penetrated this community from neighboring communities. The coverage is high, but mostly does not reach 100%. The community has been observed in the central and western parts of the isthmus.

11. *Potamogeton perfoliatus* community (Potametum perfoliati Koch 1926 em. Passarge 1964): The community of deep water (70-250 cm). It consists mostly from the monocenotic stands of *Potamogeton perfoliatus* with lower coverage (about 50%). At the stem bases *Lemna trisulca* can often be found. If other species are present in the community, it is due to the succession of neighboring communities. The community has been found in large areas in the Čivyrkujskij Bay.

12. *Potamogeton pectinatus* community (Potametum pectinati Carstensen 1955): A community poor in the number of species occurring in the water depths of about 50 cm. The coverage is rather low (about 60%). The dominant is *Potamogeton pectinatus*. Less abundantly, but *P. compressus* and sporadically also *Lemna trisulca* are always present. The community occurs in large areas near Barmašovye Lakes.

13. *Potamogeton-Myriophyllum verticillatum* community (Myriophyllo-Potametum Soó 1934): Community of medium deep water (70-100 cm), relatively rich in species. *Potamogeton lucens, P. compressus, P.*

gramineus, and less frequently *Batrachium circinatum* belong to the dominants. The coverage is high, but mostly does not reach 90%, even though the community is spread more or less constantly throughout the water column. The community has been found only in Samovo Lake.

14. *Potamogeton praelongus* community: Almost monocenotic community of *Potamogeton praelongus*, reaching the coverage of approximately 70%. Sporadically, *Lemna trisulca* also occurs. The community has been found in a lake near Kulinoe, where it covered all its area in the depth of 50-100 cm.

15. *Batrachium circinatum* community (Batrachietum circinati [Bennema et Westhoff 1943] Segal 1965): A community with low coverage (less than 50%), found in shallow waters about 50 cm deep. The prevailing taxon is *Batrachium circinatum*, accompanied by *Myriophyllum verticillatum* and various *Potamogeton* species. The community has been observed only in Samovo Lake.

16. *Utricularia intermedia-Sparganium minimum* community (Sparganietum minimi Schaaf 1925): A community of oligotrophic lakes in the central and western part of the isthmus. The coverage is mostly higher near the water surface; total coverage is 100%. The dominant species is *Utricularia intermedia* (with the coverage reaching mostly 70%), a permanent species with lower coverage is *Sparganium minimum*. In a large number of the relevés *Potamogeton gramineus* appears. The community may occur in a wide range of depths (found from 10 to 120 cm), and therefore is frequently enriched with other species which, however, have negligible coverages.

Coastal vegetation (Appendix 2)

17. *Phragmites australis* community (Phragmitetum communis [Gams 1927] Schmale 1939): A community of reed stands, with dominant *Phragmites australis*. It develops in two types. The first type is very poor in the number of species, and is formed by monocenoses with scattered *Lemna trisulca* and *Potamogeton perfoliatus* on the margins. This type was found in Čivyrkujskij Bay in the depths of 100-230 cm. The second type is very rich in species, and covers the water-logged sites near the shore line and in the wider neighborhood of hot springs, where it can be enriched with halophytes, such as *Scirpus tabernaemontanus*. Most frequently, the second type occurs in the form of reed stands with *Comarum palustre* and *Carex rostrata* being dominant in the undergrowth, while in lighter sites *Menyanthes trifoliata* and *Epilobium palustre* occur. In small areas with open water surface *Spirodella polyrhiza* and *Lemna minor* are abundant. This type was found near the shore of the Čivyrkujskij Bay.

18. *Equisetum fluviatile* community (Equisetetum fluviatilis Steffen 1931): A community with dominant *Equisetum fluviatile* with lower coverage (up to 60%), found in water 5-30 cm deep. Accompanying species are particularly *Lemna minor, Comarum palustre, Lemna trisulca, Eleocharis mamillata, Carex diandra* etc. The community was found only on Barmašovye Lakes.

19. *Polygonum belophyllum-Calamagrostis *langsdorffii* community: Grass community of shoreline sites. The stands are almost closed, the dominant *Calamagrostis purpurea* subsp. *langsdorffii* being constantly accompanied by *Polygonum belophyllum, Stachys aspera, Rumex protractus* etc. It occurs on clayey soils with the groundwater surface close to, or several dozens centimeters below, the soil surface. The community was found on the shores of Lake Arangatuj near Kordon.

20. *Scirpus tabernaemontanus* community (Schoenoplectetum tabernaemontani Rapaics 1927): A community with dominant *Scirpus tabernaemontanus*, occurring in alkaline waters with alternating water surface. It is mostly extremely poor in the number of species. The most significant accompanying species is *Lemna minor*, also *Triglochin maritimum* occurs rarely. Along the paths trampled by grazing cattle on the peripheries of saline soils a ruderalized form of the community, enriched particularly with *Senecio congestus, Bidens radiata*, and *Polygonum lapathifolium* occurs. Both types were found near Kulinoe.

21. *Hippuris vulgaris* community (Hippuridetum vulgaris Passarge 1955): A community covering shores of lakes. The coverage reaches 100%. The dominant species is *Hippuris vulgaris*, abundantly accompanied by *Utricularia intermedia, Ranunculus gmelinii* and other plants. The community was found in a wide range of water depths (0-50 cm). It represents a significant step in the process of lake terrestrialization. The community was found in central and northeastern parts of the isthmus.

22. *Eleocharis mamillata* community: A community of muddy shores. It was rarely found in larger stands. The coverage of the community is rather low (less than 80%). The dominant is always *Eleocharis mamillata*. Accompanying species are *Ranunculus reptans, R. gmelini, Lemna minor*, and *L. trisulca*. The community was found on sites with variable water depth, ranging from 0-30 cm. The community was observed on several places at small lakes near the NW border of the isthmus.

23. *Eleocharis mamillata-Sparganium minimum* community : A community from a succession developing from the *Potamogeton praelongus* community and transforming during succession into the *Menyanthes trifoliata-Carex diandra* community. It is an important stage in lake terrestrialization. The ground is completely unstable; practically in the whole profile of the water column dead or withering remnants of the

Menyanthes trifoliata-Carex diandra community (mainly *Hippuris vulgaris*) can be found in the soil without any structure. On the surface, there is a thin layer (1.5 cm) of organic particles in various stages of humification. The community has a high coverage (90-100%). The dominants are *Eleocharis mamillata* and *Sparganium minimum*, which here reach the height of 20 cm. Regular accompanying species are *Carex canescens* and *Ranunculus gmelini*. In more advanced stages of succession *Calla palustris, Menyanthes trifoliata, Comarum palustre, Carex diandra* and other species occur. On the contrary, in the initial stages *Utricularia intermedia* and *Hippuris vulgaris* can be of high coverage. The community is straggled near the lakes in the central and NW part of the isthmus.

24. *Ranunculus gmelinii* community: A community of shallow lakes and pools bound with periodically inundated sites of natural and seminatural character. The community was not found in permanently inundated places. The dominant is *Ranunculus gmelinii*, which roots in the ground and reaches the water surface. On spots not instantaneously covered with water the stand is approximately 5 cm high. Sporadically *Alisma plantago-aquatica* and *Eleocharis klingei* can be more abundant, presence of *Lemna minor* is quite regular. Being heliophilous, the community does not occur in shaded pools or forest paths. It was found near Kordon.

25. *Calla palustris* community (Callaetum palustris [van den Berghen 1952] Segal et Westhoff in Westhoff et Den Held 1969): A community of unstable soils on the margins of water surfaces, optimum in the depths of 20-40 cm. The dominant is *Calla palustris*, accompanied by *Comarum palustre, Carex diandra, C. rostrata, C. lasiocarpa* and others. In greater depths the presence of *Utricularia intermedia* and more rarely *Carex pseudocyperus* in the community is frequent. In drier sites *Naumburgia thyrsifolia* accedes. The community was found in Samovo Lake, near some lakes in the central part of the isthmus, and at Lake Arangatuj near Kordon.

Mire and bog communities (Appendix 3)

26. *Calamagrostis neglecta-Carex *wiluica* community: Grass community of water-logged sites with the groundwater surface alternating from zero to several centimeters below the ground surface. The stands are almost compact, with the dominance of *Carex juncella* subsp. *wiluica*, accompanied by *Calamagrostis neglecta, Carex appendiculata*, and other species. The moss layer, present sporadically, consists of hygrophilous species. Geologically, the ground consists of silicate sands sometimes covered with a thin layer of humolite. The community is distributed all

over the area on mire margins and at all sites where the groundwater surface is more or less at the same level as the ground. The community was described from the mires near the Posol'sk village at Lake Baikal by Savič (1937).

27. *Menyanthes trifoliata-Carex diandra* community: Sedge community permanently covered with water up to 50 cm deep. The dominants of the herb layer are *Carex diandra, C. lasiocarpa, C. rostrata*, accompanied by *Glyceria spiculosa, Eriophorum gracile, Menyanthes trifoliata, Comarum palustre* and others. In deeper water between the sedge tufts *Utricularia intermedia* commonly occurs, but is absent in drier types of the community. Mosses are rare or absent. Sandy grounds are covered by a mire peat layer sometimes more than 20-40 cm thick. This is the most frequent community of the Svjatoj Nos isthmus and covers vast areas of the whole territory. The community was described from the mires near Posol'sk village at Lake Baikal by Savič (1937).

28. *Triglochin maritimum-Tomenthypnum nitens* community: Sedge-moss community following in the terrestrialization succession sequence the preceding community. The dominants of the herb layer are *Carex diandra, C. limosa, C. lasiocarpa, C. dioica*, and in contrast to the preceding stage of succession also species bound in their existence with moss carpets (*Tomenthypnum nitens, Aulacomnium palustre, Drepanocladus* sp. div.) occur, such as *Triglochin maritimum, Oxycoccus palustris, Andromeda polifolia* etc. The peat layer reaches the thickness of up to several dozens centimeters. The community was found particularly in the NW and SE margins of the isthmus (Kulinoe, Kordon).

29. *Oxycoccus palustris-Betula *rotundifolia* community: Sedge-peatmoss community forming more advanced succession stage in the process of lake terrestrialization. The composition of the herb layer is similar to the above-mentioned community, but hygrophilous species are waning and, on the contrary, some shrubs appear, such as *Betula nana* subsp. *rotundifolia*. In the moss layer, in addition to *Tomenthypnum nitens* and *Aulacomnium palustre*, various species of *Sphagnum* are abundant. The organogenic sediment layer is dozens of centimeters thick, the water surface is several cm below the ground and does not rise over it. The community was found only in the peaty complex near Kordon.

30. *Chamaedaphne calyculata-Sphagnum magellanicum* community: Extremely oligotrophic or even ombrogenic bog community presenting the closing stage of mire succession in the area under study. The stands consist of compact carpets of peatmoss (*Sphagnum magellanicum*), in which chamaephytes *Ledum palustre, Chamaedaphne calyculata, Rubus chamaemorus*, and sporadically certain Cyperaceae species occur. Trees (often dwarf) and shrubs, such as *Betula platyphylla, Pinus sibirica, P.*

pumila are straggled along. The shape of the bog is slightly convex, and the surface is of hummock structure. The groundwater surface lies several centimeters beneath the hollows ground; upper parts of the hummocks dry out for long periods. The community was found mostly in the NW and SE part of the isthmus (Kulinoe, Kordon).

Sand and steppe communities (Appendix 4)

31. *Craniospermum subvillosum-Leymus secalinus* community: A community of sands in the surf zone of Baikal, poor in the number of species. The coverage is low (less than 20%). The dominant is *Leymus secalinus*, regularly also *Isatis oblongata*, *Polygonum baicalense* and *Scrophularia incisa* occur. The moss layer is absent. The stands of this community create a narrow strip along the shoreline in the epilittoral zone, reached in the case of risen water in Lake Baikal by the highest waves. The community was found only on the shore of Barguzinskij Bay.

32. *Papaver ledebourianum-Festuca *baicalensis* community: Primary vegetation of unstable sands. The coverage of herb layer is low, usually less then 20%. The dominants are mostly grasses with salient rhizomes, such as *Festuca rubra* subsp. *baicalensis*, *Calamagrostis epigeios*, *Carex korshinskyi* etc. The moss layer is absent. The community settles on the sand dunes with lower groundwater surface. The site is extreme, permeable for water and quickly drying, with great alternation of soil temperatures in the daily and annual cycles. The community was found in the NW part of the shore of Barguzinskij Bay in the sites where the influence of strong winds from the lake impedes the succession of the forest.

33. *Stellaria dichotoma-Rosa acicularis* community: Shrub community of relatively stabilized sand dunes which follows in the succession of the previous community. The dominant is a short shrub *Rosa acicularis*, regularly accompanied by *Leymus secalinus*, *Festuca rubra* subsp. *baicalensis*, *Stellaria dichotoma* and others. The herb layer is sporadically developed, formed mostly from *Ceratodon purpureus*. The community was found in the same sites as the previous one.

34. *Potentilla acaulis-Artemisia sericea* community: Primary xerotherm community of steep rocky slopes. The coverage of the herb layer is approximately 60-70%, the dominants are mostly *Potentilla acaulis*, *Thymus baicalensis* s.l. and *Artemisia sericea*, accompanied by other steppe species. Mosses and lichens are absent. The soil is very shallow with prevailing coarse-grained sand and gravel produced by the disintegration of mother crystallinic rocks. The community was found only on the Kovrižka hill. In the Russian geobotanical literature this community was said to correspond with mountain steppes (Peškova 1972, 1985). This community was reported from the Uškan'i islands by Ivanova

(1969). A similar vegetation was described by Guinochet (1982) and Žitluchina (1986).

35. *Schizonepeta multifida-Carex pediformis* community: Secondary xerotherm community of grasses and herbs developing as a compensatory vegetation on deforested sunny slopes. The community is almost closed without marked dominants. Major part of the species spectrum consists of steppe species. The substrate is several cm deep forest soil settling on the foundation of crystallinic rocks. The stands are used as extensive pastures. The community was found only on the Kovrižka hill.

Forest communities (Appendix 5)

36. *Carex pediformis-Larix sibirica* community: Mesophilous forest community occurring on mild slopes at the foot of the mountains along Baikal coast. The species spectrum is influenced by the cooling effect of the lake. The tree layer dominants are *Larix sibirica* and *Pinus sylvestris*. In the shrub layer *Rhododendron dauricum* usually prevails. The herb layer is formed from herb and grass hemicryptophytes and chamaephytes. The moss layer consists mostly of *Pleurozium schreberi*. The soil lays on the disintegrated crystallinic rocks. In the sites influenced by previous fires or logging the composition of the tree layer changes in favor of *Populus tremula, Betula platyphylla* and *B. pendula*, the composition of the herb layer remains more or less the same. The community does not occur in the area under study, but borders it on the NW and SE. Similar communities were found by Guinochet (1982).

37. *Rhodococcum vitis-idaea-Pinus sylvestris* community: A community of xerophilous pine forests on the plains created by sandy sediments of Baikal. The tree layer consists of *Pinus sylvestris*, in the shrub layer *Rhododendron dauricum* prevails. The herb layer is poor in the number of species, usually with dominant *Vaccinium vitis-idaea* accompanied by *Festuca ovina* and some other xerophilous species. In the moss layer *Pleurozium schreberi, Dicranum undulatum* and various species of *Cladonia* prevail. The soil consists of silicate sand with very low content of clayey particles. It is therefore acidic and due to its good permeability dries out quickly. The community is found on the higher parts of coastal banks along the coast of Barguzinskij Bay outside the influence of the groundwater and of strong winds.

38. *Carex canescens-Pinus sylvestris* community: The community of hygrophilous swampy forests on the sandy sediments with the groundwater near the soil surface. In the tree layer *Larix sibirica* or *Pinus sylvestris*, and in shrub layer *Betula platyphylla* and *Duschekia fruticosa* among others, prevail. The herb layer consists of various hygrophilous chamaephytes (*Ledum palustre, Vaccinium uliginosum*, etc.) and hemi-

cryptophytes (*Calamagrostis neglecta*, *Carex canescens*, etc.). In the moss layer particularly the mire species (*Sphagnum* sp. div., *Polytrichum commune*, etc.) are found. The soil is sandy, with considerable accumulation of plant detritus. Gradual peating may lead to the bog succession. The community was observed in lower parts of sandy shore banks along the coast of Barguzinskij Bay.

39. *Chamaedaphne calyculata-Pinus sibirica* community: A community of peaty forests, forming the intermediate phase of succession between the above-mentioned community and an open bog, i.e. the *Chamaedaphne calyculata-Sphagnum magellanicum* community. The substrate is a peat layer several dozens of centimeters thick. The tree layer is very loose, and consists mainly of *Pinus sibirica*, *Betula platyphylla*, locally *Larix sibirica*. In the shrub layer mostly juvenile individuals of tree layer species are found. In the herb layer especially chamaephytes *Ledum palustre*, *Chamaedaphne calyculata* and *Vaccinium uliginosum* prevail. The ground layer is mostly formed from peatmoss species *Sphagnum* sect. *Cuspidata*, *S. rubellum*, and *S. magellanicum*. The community was observed on the NW and SE margins of the isthmus.

40. *Padus avium-Pinus sibirica* community: Small-area community islanded on the sands along the Baikal shoreline influenced by the strongest winds from the lake, forming there the last stage of succession. The tree layer is thin, formed from *Pinus sibirica* with wind-shaped tops. The shrub layer with high coverage consists of *Padus avium*, *Sorbus sibirica*, *Rosa acicularis*, *Pinus pumila* etc. In the herb layer, in addition to the species of neighboring sandbanks (*Stellaria dichotoma*, among others) the species of large-area taiga forests (e.g. *Maianthemum bifolium*) as well as forest moss species (*Pleurozium schreberi*) occur. The soil is sandy, with very small amount of clay particles. The sites are relatively cold and wet due to their contact with the lake. The community is found on the NW part of the Barguzinskij Bay shore (near El'zicha, Kedrovka).

Ruderal and subruderal vegetation (Appendix 6)

41. *Carex bohemica* community: A community of disturbed soils with stagnating water on the fine-to-coarse-grained sands with dominant *Carex bohemica*, *Juncus bufonius* and *J. alpino-articulatus*. Permanent accompanying species are *Ranunculus reptans* and *Callitriche palustris* nearer to the water surface. The community was found only on two sites along the road between Ust'-Barguzin and Kedrovka.

42. *Juncus bufonius-Plantago depressa* community: A community of disturbed water-logged sands, even considerably euthrophicated. It was also found on very intensively trampled paths of grazing cattle. The dominants are *Juncus bufonius* s.l., *Plantago depressa*, and, depending on

the site type, also *Potentilla anserina*. The community was observed near the entrance to the Park and at Barmašovye Lakes.

43. *Triglochin palustre-Polygonum minor* community: Subhalophilous community of mostly annual plants, found on bare saline soils of lakes near the hot springs and small streams flowing from them. The coverage of the community is low (50%). To the indicative species belong *Triglochin palustre, Polygonum minor*, and, more rarely, *Triglochin maritima. Scirpus tabernaemontani* often spreads from neighboring stands. A ruderalized form of the community, enriched with *Polygonum lapathifolium, Bidens radiata, Senecio congestus, Potentilla anserina, Rorippa palustris, Juncus bufonius* s.l. and others, was found on the cattle-trampled paths near Kulinoe. By its species spectrum the community approximates the *Juncus bufonius-Plantago depressa* community. Its presence was noted near Kulinoe.

44. *Urtica cannabina* community: Nitrophilous community of perennial plants on the pastures with dominant *Urtica cannabina*, accompanied by *Lamium album, Artemisia vulgaris, Cirsium setosum* etc. The community was found on the pastures near Kulinoe.

45. *Matricaria discoidea-Polygonum aviculare* community: The community of trampled habitats near roads and settlements. It occurs in small covers. The basis of the species spectrum are low hemicryptophytes *Matricaria discoidea, Polygonum aviculare, Plantago major* etc., locally adventitious expansively spreading species *Hordeum jubatum* penetrates into the stands.

Vegetation patterns along environmental gradients; succession

The Svjatoj nos isthmus can be divided into several natural units with different habitat conditions and with different vegetation development:

1. Coastal zone of the SW shoreline with sandy bank dunes influenced by wind and surf.
2. Central part of the isthmus with permanently water-logged sandy sediments and coastal banks.
3. Northern part of the isthmus with accumulation of more eutrophic clay sediments.
4. NW and SE margins of the isthmus near the border with the mainland.
5. Small area protrusions of crystallinic rocks.

Coastal zone of the SW shoreline

SW coast of the isthmus is formed from sandy shore banks, a few up to dozens of meters broad, on which the vegetation depends on two main ecological factors: groundwater surface and wind. The basic types of

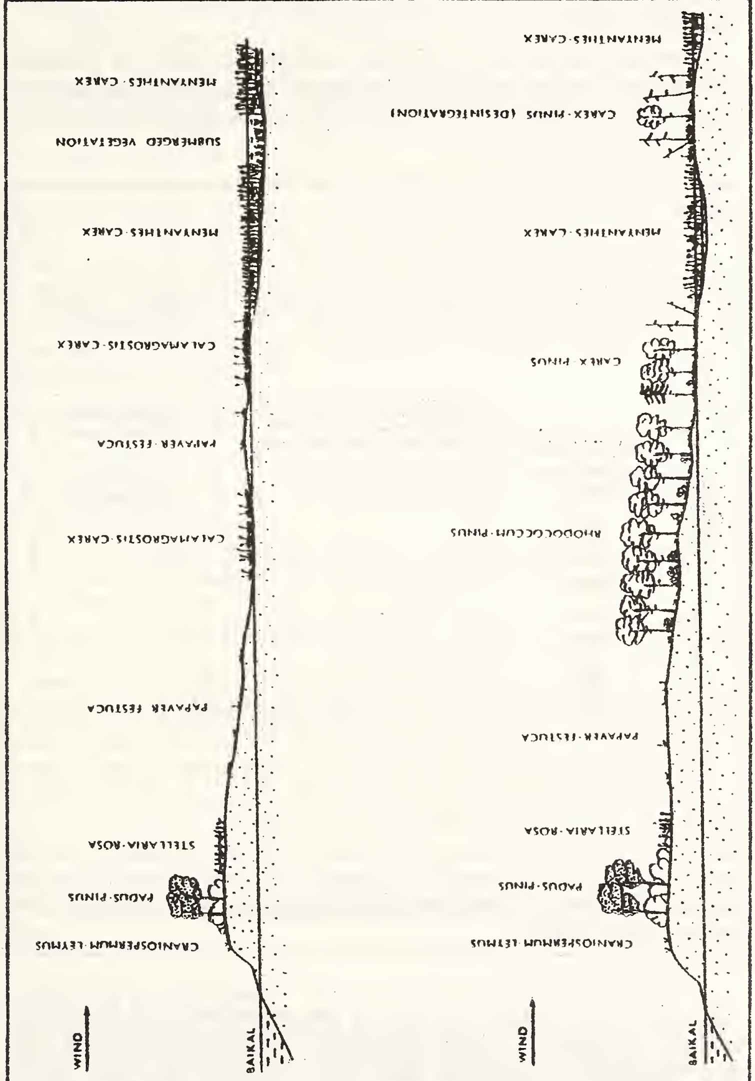


Fig. 1. Basic types of zonation of the vegetation on the transect perpendicular to the shoreline of Barguzinskij Bay on the Svjatoj Nos isthmus, Lake Baikal.

zonation of the vegetation on the transect perpendicular to the shoreline are shown in Fig. 1.

Under the influence of groundwater surface oscillations in long-term intervals even both-directional succession transitions between neighboring communities of the gradient of groundwater depth can be expected (Fig. 2).

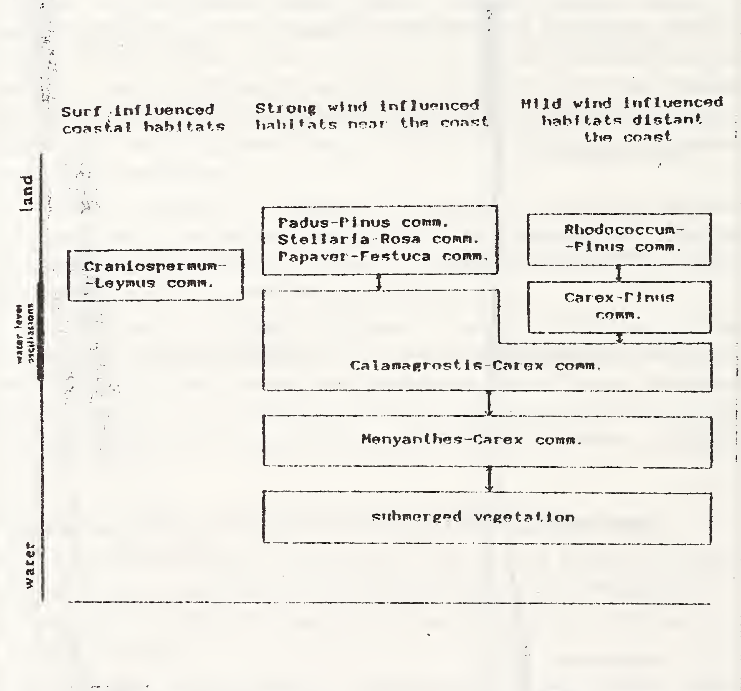
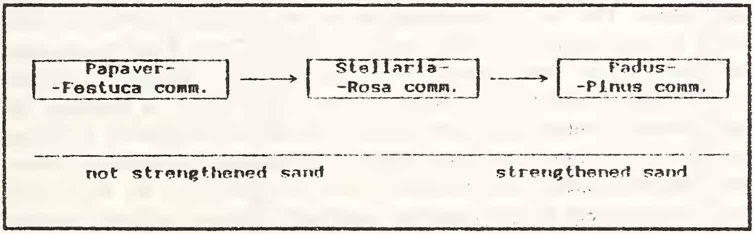

Surf influenced coastal habitats
Strong wind influenced habitats near the coast
Mild wind influenced habitats distant the coast
land
water level oscillations
water
Craniospermum--Leymus comm.
Padus-Pinus comm.
Stellaria-Rosa comm.
Papaver-Festuca comm.
Rhodococcum--Pinus comm.
Carex-Pinus comm.
Calamagrostis-Carex comm.
Menyanthes-Carex comm.
submerged vegetation

Fig. 2. Succession of the sand dune vegetation on the Svjatoj Nos isthmus, Lake Baikal.

Following the artificial increase of the water level in Lake Baikal, caused by building the Irkutsk dam (1962), particularly succession from the communities located in the upper part of Fig. 2 into the lower located communities can be observed. This is proven by the occurrence of dead forests being gradually replaced by the *Calamagrostis neglecta-Carex* **wiluica* community.

The strip of the shoreline within the reach of highest waves is settled by the *Craniospermum subvillosum-Leymus secalinus* community. The succession of this community is impeded by the surf. If the shore bank is broad enough, the narrow strip of this community borders with another belt, which is not exposed to the surf, but is influenced by strong winds from Baikal impeding the development of close forest vegetation. The belt is then created by unstable sand dunes covered by psammophilous vegetation. Unstable moving sands are settled in the first stage by the *Papaver ledebourianum-Festuca *baicalensis* community. The succession of this vegetation enables stabilizing the sand dunes, after the process of which the *Stellaria dichotoma-Rosa acicularis* community develops, changing gradually into the *Padus avium-Pinus sibirica* community. The succession of the sand dunes vegetation can be then described by the following scheme (Fig. 3):



Among the dunes there are depressions sometimes reaching the groundwater level. In that case they are settled by the *Calamagrostis neglecta-Carex *wiluica* community. In the sections where the shore bank is broad enough usually close forests are found on the wind-protected places further from the lake. In the habitats with a thicker layer of sand and in the direct reach of groundwater the *Rhodococcum vitis-idaea-Pinus sylvestris* community is found. After a long-term lift of the groundwater level the trees die out and the composition of the stand changes, resulting in the development of the *Calamagrostis neglecta-Carex *wiluica* community.

Central part of the isthmus

The central part of the isthmus is formed from sandy sediments covered with water, usually 50-70 cm deep. These habitats are overgrown by vast stands of the *Menyanthes trifoliata-Carex diandra* community. This succession can take place in two ways (in a simplified model):

(1) The most common is the direct succession of *Menyanthes trifoliata*, which within the frame of the *Menyanthes trifoliata-Carex diandra*

community in the transitions to the open surface creates nearly monocenotic stands. After the surface is partially covered by the leaves from the foliate rhizomes of *Menyanthes trifoliata*, thus being protected against the waves, *Comarum palustre* followed by *Carex diandra, Naumburgia thyrsiflora*, and other species of the *Menyanthes trifoliata-Carex diandra* community spread rapidly. Rarely this succession is preceded by the *Calla palustris* community, which, as a result of firm rhizomes of *Calla palustris*, better resists the surface motion. This way of spreading does not depend on the presence of euhydatophytes and not even on the water depth. The *Menyanthes trifoliata-Carex diandra* community forms fully close carpet floating on the surface and only deep behind the "succession forehead" so-called terrestrialization from the top takes place.

(2) The second way of succession is much rarer than the former one. It is based on the slow spreading of *Menyanthes trifoliata-Carex diandra* community, i.e. rapid spreading of the communities terrestrialized from the bottom. This way of terrestrialization can take place only on the new islets where the species of *Menyanthes trifoliata-Carex diandra* community have not yet been present or in the sites with strongly developed submerged vegetation. This means: at first the mogzon is inhabited by hydatophyte communities (*Utricularia intermedia-Sparganium minimum* comm., *Batrachium circinatum* comm., *Potamogeton perfoliatus* comm. etc. and after partial terrestrialization and thus sinking of the water level (to approximately 40 cm) precedes especially *Hippuris vulgaris* community on these sites which reaches over 90% coverage in the whole water column. In this stage either the direct spreading of *Menyanthes trifoliata-Carex diandra* community with facultative foregoing spreading of *Calla palustris* community takes place or in rarer case succession of *Menyanthes trifoliata-Carex diandra* community follows the foregoing succession of *Eleocharis mamillata-Sparganium gramineum* community.

The *Menyanthes trifoliata-Carex diandra* community stands are interrupted by numerous sandy shore banks of various width and approximately the same height, which are spread paralelly along the SW shore of the isthmus. Their vegetation depends on the groundwater level. The communities of the humidity scale shown in Fig. 2, starting from the *Rhodococcum vitis-idaea-Pinus sylvestris* community to the *Calamagrostis neglecta-Carex *wiluica* communities are concerned. The mutual succession transitions among those communities depending on both natural and artificial oscillations of water in Lake Baikal are subject to the same rules as stated in Fig. 2.

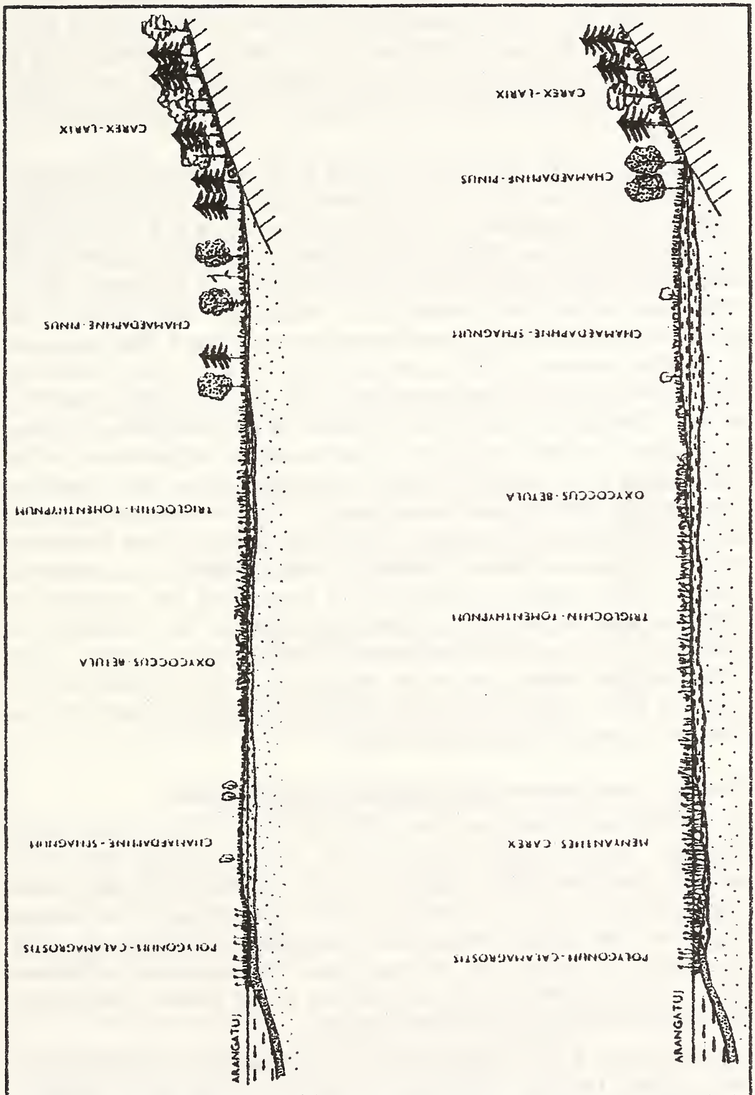


Fig. 4. Basic types of zonation of the vegetation on the transect perpendicular to the shoreline of Lake Arangatuj in the northern part of the Svjatoj Nos isthmus, Lake Baikal.

Northern part of the isthmus

The northern part of the isthmus consists of sandy sediments on the surface, covered by water usually 50-70 cm deep, which may be overgrown with the *Menyanthes trifoliata-Carex diandra* community, and in places with shallower water by *Calamagrostis neglecta-Carex *wiluica* community. The phenomenon of small lakes with submerged vegetation is also present.

In addition to the vegetation occurring in the oligotrophic central part of the isthmus, other types of the vegetation depending on more eutrophic substrate with accumulations of clay substances occur in Lake Arangatuj and Istok river area. Mainly the *Phragmites australis* community is concerned. In the coastal part of Lake Arangatuj the occurrence of the *Polygonum belophyllum-Calamagrostis *langsdorffii* was proven. In an area of several hectares dozens of hot springs were found. The temperature oscillates between 22-59°C, and the springs contain a large amount of salts depositing on the vegetation (NaCl, (Zn, Fe, Mn) $(SO_4)_n$, Na_2CO_3, etc.) (cf. Tkačuk et al. 1957). The occurrence of local halophilous vegetation is given by those conditions. In the immediate neighborhood of the lakes taking water from the springs is not covered by any vegetation (evidently for high temperature and salinity). The first community spreading on the margins of the lakes and drying bottoms is the *Triglochin palustre-Polygonum minor* community, which occurs in a somewhat changed form (perhaps secondarily) in eutrophized and trampled or disturbed water-logged sites of the whole isthmus. The community is followed by *Scirpus tabernaemontanus* community poor in species, only in the trampled habitats and on the transitions to other communities is it richer to some extent. In the sites with lower salt concentration the *Phragmites australis* community occurs.

Margins of the isthmus on the transition to the mainland

On the NW and SE margins of the isthmus from the water-covered sandy sediments the crystallinic rocks covered in some places with slope substrate stand out. Their vegetation cover is formed from the *Carex pediformis-Larix sibirica* community in the neighborhood of the isthmus linked with the isthmus vegetation by numerous transitions, the most characteristic of which being the peaty forest *Chamaedaphne calyculata-Pinus sibirica* community, in the direction to the isthmus passing into various mire and bog communities (Fig. 4).

Turfization is a typical phenomenon of the transition of the isthmus to the mainland. The mire succession can take place in two ways: paludification and terrestrialization. The terrestrialization begins particularly in the case of long-term stagnation of water in the mire communities of *Meny-*

anthes trifoliata-Carex diandra, when the oxygen dissolved in the water is used for the oxidation of the accumulated humus, which leads to the creation of peat. By means of the development of the moss synusia the community changes into more advanced peaty communities (_Triglochin maritima-Tomenthypnum nitens_, _Oxycoccus palustris-Betula *rotundifolia_) and may culminate in the development of the bog-type community (_Chamaedaphne calyculata-Sphagnum magellanicum_). In the process of paludification the waterlogging of the forests on the contact with the mire (_Rhodococcum vitis-idaea-Pinus sylvestris_ or _Carex pediformis-Larix sibirica_), the _Chamaedaphne calyculata-Pinus sibirica_ community is created, and the oxygen deficit in the soil leads to the accumulation of peat and development of a bog. The succession scheme is shown in Fig. 5.

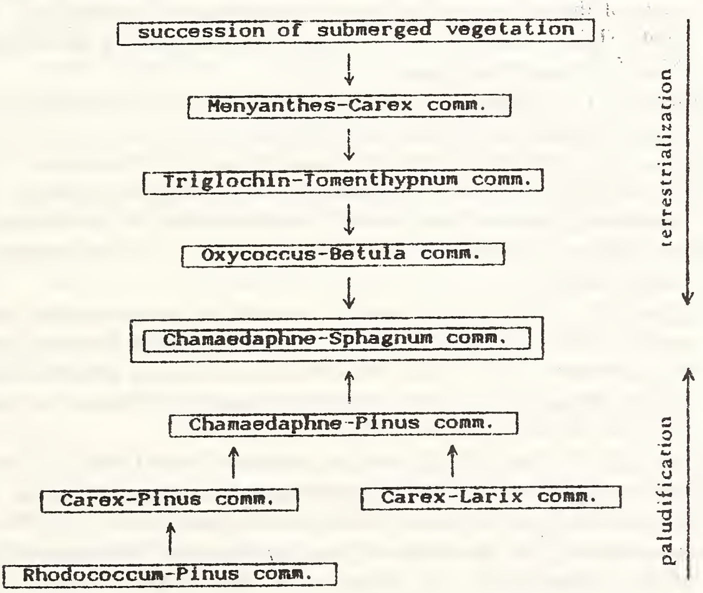


Fig. 5. Succession scheme of plant communities at the northern shore of Lake Arangatuj on the Svjatoj Nos isthmus, Lake Baikal.

Crystallinic protrusions

On the protrusions of the crystallinic rocks in central part of the isthmus the vegetation is completely different. The Kovrižka hill in central part of the isthmus is overgrown by mostly secondary vegetation changed by clearing or forest fires and subsequent grazing. In the natural status most probably the N, W, and E slopes were covered by forest (the *Carex pediformis-Larix sibirica* community), while the steep southern slopes were overgrown by steppe vegetation *(Potentilla acaulis-Artemisia sericea* community), probably with straggled *Pinus sylvestris* or *Larix sibirica*. The northern slope is now covered by secondary forest with *Betula pendula, B. platyphylla*, and *Populus tremula*, and the western slope by secondary steppe pasture (*Schizonepeta multifida-Carex pediformis* community), on the southern slope the steppe communities *Potentilla acaulis-Artemisia sericea* are preserved.

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Appendix 1. Water communities.

Synthetical relevé Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nr. of relevés synthetized	3	2	4	5	3	7	2	3	4	4	4	2	3	1	3	10
Lemna trisulca	100(45)	50(11)	100(-1)	100(+2)	100(+1)	•	100(++)	100(++)	100(12)	•	100(11)	100(-+)	67(-1)	100(++)	33(22)	•
Lemna minor	67(+2)	100(45)	100(+2)	100(+2)	•	•	•	•	75(+2)	•	•	•	•	•	•	•
Spirodella polyrhiza	•	•	100(35)	•	•	•	•	•	•	•	•	•	•	•	•	•
Utricularia vulgaris	•	•	25(++)	100(45)	•	•	•	•	•	•	•	•	•	•	•	•
Ceratophyllum demersum	•	•	•	•	100(55)	•	•	•	50(12)	•	•	•	•	•	•	•
Nymphaea tetragona	•	•	•	•	•	100(14)	50(--)	67(--)	•	•	50(-+)	•	67(+1)	•	•	30(-+)
Polygonum amphibium	•	•	•	•	•	43(-+)	100(55)	•	•	50(+1)	•	•	•	•	•	•
Sparganium gramineum	•	•	•	•	•	57(+1)	50(++)	100(34)	•	•	50(--)	•	•	•	•	100(-2)
Potamogeton gramineus	•	•	•	•	•	•	•	•	100(24)	50(-1)	•	•	67(12)	•	33(++)	60(-2)
Callitriche palustris	•	•	•	•	•	•	•	•	75(+3)	50(11)	•	•	•	•	•	•
Potamogeton lucens	•	•	•	•	•	•	•	•	•	100(34)	•	•	100(+3)	•	67(+1)	20(++)
Potamogeton perfoliatus	•	•	•	•	•	29(++)	•	67(++)	•	•	100(23)	•	•	•	67(+1)	•
Potamogeton pectinatus	•	•	•	•	•	•	•	•	•	•	•	100(34)	•	•	•	•
Potamogeton compressus	•	•	•	•	•	•	•	•	•	•	•	100(+2)	100(23)	•	•	•
Potamogeton praelongus	•	•	•	•	•	•	•	•	•	•	•	•	•	100(55)	•	40(-1)
Ranunculus circinatus	•	•	•	•	•	•	•	•	•	75(+2)	•	•	100(-+)	•	100(23)	•
Utricularia intermedia	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	100(35)
Myriophylium verticillatum	•	•	•	•	•	57(+2)	•	•	•	75(+1)	•	•	100(12)	•	67(+2)	•
Potamogeton perfoliatus	33(++)	•	•	•	•	•	100(-+)	•	•	25(11)	•	•	•	•	•	•
Phragmites australis	•	•	•	•	•	•	•	33(++)	•	•	75(-+)	•	•	•	•	•
Utricularia vulgaris	•	•	•	•	•	43(++)	•	•	•	•	•	•	•	•	•	•
Potamogeton pusillus	•	•	•	•	•	•	•	•	75(+1)	•	•	•	•	•	•	•
Carex diandra	•	•	•	•	•	29(-+)	•	•	•	•	•	•	•	•	•	•

Appendix 2. Coastal communities.

Synthetical relevé Nr.	17	18	19	20	21	22	23	24	25
Nr. of relevés synthetized	4	1	4	3	6	5	5	3	2
E1 - herb layer									
Phragmites australis	100(34)	•	•	•	•	•	•	•	•
Equisetum fluviatile	•	100(33)	•	•	33(+1)	•	•	•	•
Calamagrostis purpurea ssp. *langsdorffii*	•	•	100(45)	•	•	•	•	•	•
Polygonum belophyllum	•	•	100(+1)	•	•	•	•	•	•
Rumex protractus	•	•	100(+1)	•	•	20(11)	•	•	•
Stachys aspera	•	•	75(+1)	•	•	•	•	•	•
Rorippa palustris	•	•	75(++)	•	•	•	•	•	•
Galium trifidum	•	•	50(++)	•	•	•	•	•	•
Iris laevigata	•	•	50(++)	•	•	•	•	•	•
Scirpus tabernaemontani	•	•	•	100(45)	•	•	•	•	•
Hippuris vulgaris	•	•	•	•	100(34)	•	80(-1)	•	•
Utricularia intermedia	•	•	•	•	100(12)	•	•	•	•
Eleocharis mamillata	•	100(11)	•	•	•	100(34)	100(34)	•	•
Utricularia vulgaris	•	100(11)	•	•	•	•	100(+1)	•	50(++)
Sparganium minimum	•	•	•	•	•	•	100(23)	•	•
Carex cannescens	•	•	•	•	•	•	100(-1)	•	•
Ranunculus gmelinii	•	•	•	•	100(-1)	60(+1)	100(+1)	100(45)	•
Calla palustris	•	•	•	•	•	•	60(++)	•	100(55)
Carex rostrata	•	•	•	•	•	•	•	•	100(++)
Carex lasiocarpa	•	•	•	•	•	•	•	•	100(++)
Comarum palustre	50(22)	100(11)	75(++)	•	33(-+)	20(--)	40(++)	•	50(++)
Carex diandra	50(12)	100(++)	•	•	•	•	40(++)	•	100(+1)
Lemna trisulca	50(11)	100(11)	•	•	67(+2)	60(++)	•	•	•
Menyanthes trifoliata	50(+2)	•	25(++)	•	•	•	80(-+)	•	•
Spirodella polyrhiza	50(++)	•	25(++)	•	•	•	•	•	•
Epilobium palustre	50(++)	•	25(++)	•	•	•	•	•	•
Polygonum amphibium	50(++)	•	•	•	•	•	•	•	•
Lemna minor	50(-+)	100(11)	•	67(11)	•	80(+1)	•	100(++)	•
Potamogeton perfoliatus	50(-+)	•	•	•	•	•	•	•	•
Filipendula ulnaria	25(++)	•	•	•	•	•	•	•	•
Pedicularis sp.	25(--)	•	•	•	•	•	•	•	•
Bidens radiata	•	•	25(++)	33(11)	•	•	•	•	•
Bidens cernua	•	•	25(++)	•	•	•	•	•	•
Polygonum hydropiper	•	•	25(++)	•	•	•	•	•	•
Galium uliginosum	•	•	25(++)	•	•	•	•	•	•
Lactuca sibirica	•	•	25(++)	•	•	•	•	•	•
Lathyrus pilosus	•	•	25(--)	•	•	•	•	•	•
Carex sp.	•	•	•	67(++)	•	•	•	•	•
Poa sp.	•	•	•	67(++)	•	•	•	•	•
Polygonum lapathifolium	•	•	•	67(-2)	•	20(++)	•	•	•
Inula britannica	•	•	•	33(11)	•	•	•	•	•
Myriophyllum verticillatum	•	•	•	•	33(+1)	•	•	•	•
Nymphaea tetragona	•	•	•	•	33(--)	•	•	•	•

Ranunculus reptans	•	•	•	•	•	60(+1)	•	•	•
Potentilla anserina	•	•	•	•	•	20(22)	•	•	•
Ranunculus sceleratus	•	•	•	•	•	20(11)	•	•	•
Carex juncella ssp. *wiluica*	•	•	•	•	•	20(++)	•	•	•
Alisma plantago-aquatica	•	•	•	•	•	•	•	67(+2)	•
Eleocharis klingei	•	•	•	•	•	•	•	67(+1)	•
Carex pseudocyperus	•	•	•	•	•	•	•	•	50(--)
Namburgia thyrsiflora	•	•	•	•	•	•	•	•	50(--)
E0 - ground cryptogam layer									
Amblystegium kochii	•	•	50(22)	•	•	•	•	•	•
Leptobryum pyriforme	•	•	50(22)	•	•	•	•	•	•

Appendix 3. Mire and bog communities.

Synthetical relevé	**26**	**27**	**28**	**29**	**30**
Nr. of relevés synthetized	12	18	13	7	9
E2 - shrub layer					
Pinus sibirica	•	•	•	•	44(12)
Pinus pumila	•	•	•	•	44(12)
Betula platyphylla	•	•	•	•	44(12)
Betula pubescens	•	•	•	•	44(+1)
Betula pendula	8(11)	•	8(11)	•	•
Betula fruticosa	•	•	31(11)	•	33(++)
E1 - herb layer					
Carex juncella ssp. *wiluica*	100(+5)	39(-2)	8(++)	•	•
Calamagrostis neglecta	100(+5)	28(+2)	31(+2)	29(+1)	•
Carex appendiculata	42(12)	•	•	•	•
Spiraea salicifolia	42(+2)	6(++)	•	•	•
Carex rostrata	33(-1)	94(+3)	54(-1)	14(++)	•
Utricularia intermedia	17(++)	78(14)	38(-1)	•	•
Carex lasiocarpa	•	78(+3)	23(++)	•	•
Andromeda polifolia	•	•	85(+1)	•	•
Triglochin maritima	•	•	77(+1)	14(++)	•
Pyrola rotundifolia	•	•	8(++)	100(+1)	•
Baeothryon alpinum	•	•	•	71(-1)	•
Betula platyphylla juv.	•	•	•	57(+1)	•
Cardamine pratensis	•	•	•	57(++)	•
Chamaedaphne calyculata	•	•	23(-1)	•	100(13)
Rubus chamaemorus	•	•	8(++)	•	100(+2)
Ledum palustre	•	•	8(22)	•	78(23)
Vaccinium uliginosum	8(++)	•	•	•	56(+1)

Smilacine trifolia	•	•	•	•	44(-1)
Comarum palustre	67(+2)	94(-4)	85(-2)	29(--)	•
Naumburgia thyrsiflora	33(++)	56(-1)	15(++)	•	•
Epilobium palustre	25(+1)	28(-1)	62(-+)	14(++)	•
Menyanthes trifoliata	8(++)	78(+4)	85(13)	29(++)	•
Eriophorum gracile	8(++)	72(+2)	54(-+)	14(++)	•
Carex diandra	8(11)	56(12)	85(-2)	29(+2)	•
Carex limosa	•	56(-1)	92(+2)	71(11)	•
Carex dioica	•	•	54(+2)	57(+2)	•
Betula nana ssp. *rotundifolia*	•	•	69(+2)	100(+3)	67(+2)
Oxycoccus palustris	•	•	85(+2)	71(+2)	33(+1)
Oxycoccus microcarpus	•	6(++)	69(+1)	86(+2)	100(+2)
Drosera rotundifolia	•	•	67(+2)	71(++)	78(+1)
Calamagrostis purpurea ssp. *langsdorffii*	33(+2)	17(+2)	•	•	•
Rumex protractus	33(+1)	11(+1)	•	•	•
Salix myrtilloides	25(+1)	33(-1)	8(++)	•	•
Cicuta virosa	25(++)	•	15(++)	•	•
Carex canescens	17(+1)	22(-1)	15(-1)	•	44(-1)
Carex chordorrhiza	17(+1)	22(13)	•	•	•
Triglochin palustre	17(+1)	•	•	•	•
Euphasia stricta	17(++)	•	•	•	•
Salix rosmarinifolia	17(-1)	•	8(++)	•	•
Glyceria spiculosa	8(22)	22(+2)	15(+2)	14(22)	11(11)
Lemna minor	8(11)	17(+1)	•	•	•
Stachys aspera	8(11)	11(-1)	•	•	•
Salix pseudopentandra	8(11)	•	•	•	•
Scolochloa festucacea	8(11)	•	•	•	•
Agrostis sp.	8(++)	•	•	•	•
Beckmannia syzigachne	8(++)	•	•	•	•
Galium trifidum	8(++)	•	•	•	•
Polygonum hydropiper	8(++)	•	•	•	•
Potentilla norvegica	8(++)	•	•	•	•
Rorippa palustris	8(++)	•	•	•	•
Rumex acetosella	8(++)	•	•	•	•
Senecio congestus	8(++)	•	•	•	•
Equisetum fluviatile	8(--)	28(-2)	31(+1)	•	•
Polygonum amphibium	•	22(-+)	•	•	•
Carex disticha ssp. *lithophila*	•	17(++)	•	•	•
Iris laevigata	•	11(++)	•	•	•
Pedicularis karoi	•	11(--)	38(-+)	•	•
Spirodella polyrhiza	•	6(11)	•	•	•
Eriophorum russeolum	•	6(++)	15(12)	•	33(+1)
Peucedanum salinum	•	6(--)	31(-+)	•	•
Polygonum belophyllum	•	6(--)	•	•	•

Drosera anglica	•	•	38(+1)	•	•
Dactylorhiza incarnata	•	•	23(+1)	•	•
Scheuchzeria palustris	•	•	23(++)	•	•
Dactylorhiza cruenta	•	•	23(-+)	•	•
Spiranthes amoena	•	•	15(++)	•	•
Herminium monorchis	•	•	15(++)	•	•
Pinus sylvestris juv.	•	•	8(11)	•	•
Drosera x *obovata*	•	•	8(++)	•	•
Equisetum arvense	•	•	8(++)	•	•
Saxifraga hirculus	•	•	8(++)	29(-+)	•
Galium uliginosum	•	•	8(--)	•	•
Hammarbya paludosa	•	•	8(--)	14(--)	•
Pedicularis labradorica	•	•	8(--)	•	•
Poa sp.	•	•	•	43(-1)	•
Corallorhiza trifida	•	•	•	29(++)	•
Moehringia laterifolia	•	•	•	29(-+)	•
Dactylorhiza incarnata	•	•	•	14(--)	•
Betula sp. juv.	•	•	•	•	22(++)
Ledum palustre ssp. *decumbens*	•	•	•	•	11(22)
Betula x *pseudomiddendorffii*	•	•	•	•	11(++)
E0 - ground cryptogam layer					
Paludella squarrosa	•	•	31(+1)	•	•
Sphagnum magellanicum	•	•	•	29(+1)	100(34)
Sphagnum rubellum	•	•	8(11)	29(22)	89(12)
Cladina stellaris	•	•	•	•	44(+1)
Cladonia sulphurina	•	•	•	•	44(-+)
Cladina arbuscula	•	•	•	•	33(++)
Polytrichum strictum	•	•	•	•	33(--)
Icmadophila ericetorum	•	•	•	•	22(--)
Drepanocladus aduncus	50(12)	44(+2)	•	•	•
Calliergon giganteum	17(+2)	33(13)	15(+2)	•	•
Drepanocladus vernicosus	•	11(+1)	38(+3)	•	•
Meesia triquetra	•	11(+1)	23(12)	•	•
Drepanocladus exannullatus	•	11(+1)	15(+1)	•	•
Tomenthyphnum nitens	•	•	92(14)	100(24)	•
Aulacomnium palustre	8(11)	•	62(+3)	57(13)	•
Sphagnum teres	•	11(4)	62(+3)	86(23)	33(11)
Sphagnum sect. *Cuspidata*	•	•	77(14)	29(33)	44(+1)
Sphagnum fallax	•	•	15(11)	43(11)	56(22)
Ceratodon purpureus	8(22)	•	•	•	•
Polytrichum commune	8(11)	•	•	•	•
Leptodictyum riparium	8(++)	•	•	•	•
Rhizomnium magnifolium	•	11(22)	•	•	•
Sphagnum warnstorfii	•	•	31(+1)	•	•

Calliergon cordifolium	•	•	8(11)	•	•
Calliergon stramineum	•	•	8(11)	•	•
Helodium blandowii	•	•	15(++)	•	•
Cetraria islandica	•	•	•	•	11(++)

Appendix 4. Sand and steppe communities.

Synthetical relevé Nr.	**31**	**32**	**33**	**34**	**35**
Nr. of relevés synthtized	6	3	3	1	2
E1 - herb layer					
Isatis oblongata	100(-1)	•	•	•	•
Craniospermum subvillosum	50(-+)	•	•	•	•
Oxytropis lanata	•	100(+2)	33(++)	•	•
Papaver lederbournianum	•	100(++)	•	•	•
Carex korshinkyi	•	67(+2)	•	•	•
Phlojodicarpus baicalensis	•	•	67(++)	•	•
Stellaris dichotoma	•	•	67(++)	•	•
Orostachys spinosa	•	•	•	100(22)	•
Agropyron pectinatum	•	•	•	100(11)	•
Potentilla acaulis	•	•	•	100(++)	•
Scorzonera radiata	•	•	•	100(++)	•
Hieracium umbellatum	•	•	•	100(--)	•
Achillea asiatica	•	•	•	•	100(+2)
Heteropappus altaicus	•	•	•	•	100(12)
Vicia nervata	•	•	•	•	100(12)
Bupleurum scorzonerifolium	•	•	•	•	100(+1)
Helictotrichon schellianum	•	•	•	•	100(++)
Trifolium lupinaster	•	•	•	•	100(++)
Scrophularia incisa	83(--)	100(++)	•	•	•
Fesctuca rubra ssp. *baicalensis*	•	100(12)	100(+1)	•	•
Calamagrostis epigeios	•	100(+1)	67(12)	•	•
Rosa acicularis	•	67(-+)	100(24)	•	•
Leymus secalinus	100(+2)	•	67(+2)	•	•
Polygonum baicalense	83(++)	100(+1)	100(11)	•	•
Poa angustifolia	•	•	•	100(22)	100(+1)
Pulsatilla patens s.l.	•	•	•	100(22)	50(22)
Galium verum	•	•	33(++)	100(11)	100(12)
Artemisia sericea	•	•	•	100(11)	100(11)
Festuca ovina s.l.	•	•	•	100(11)	100(+1)
Dianthus versicolor	•	•	•	100(11)	100(+1)
Koeleria gracilis	•	•	•	100(11)	50(++)

Carex pediformis	•	•	•	100(++)	100(+2)
Carex korshinskyi	•	•	•	100(++)	50(22)
Allium splendens	•	•	•	100(++)	50(++)
Artemisia frigida	•	•	•	100(++)	50(++)
Veronica incana	•	•	•	100(++)	50(++)
Carex sabulosa	17(--)	•	33(++)	•	•
Silene repens	•	33(--)	67(-1)	•	50(++)
Corispermum ulopterum	•	33(--)	33(--)	•	•
Artemisia commutata	•	•	33(22)	•	50(++)
Bromopsis pumpelliana	•	•	33(++)	•	•
Cotoneaster melanocarpa juv.	•	•	33(++)	•	•
Polygonum sericeum	•	•	33(++)	•	•
Pinus sibirica juv.	•	•	33(--)	•	•
Artemisia tanacetifolia	•	•	•	•	50(22)
Plantago media	•	•	•	•	50(22)
Schizonepeta multifida	•	•	•	•	50(22)
Astragalus inopinatus	•	•	•	•	50(11)
Phlomis tuberosa	•	•	•	•	50(11)
Delphinium grandiflorum	•	•	•	•	50(11)
Polygala hybrida	•	•	•	•	50(++)
Bromus inermis	•	•	•	•	50(++)
Papaver nudicaule	•	•	•	•	50(++)
Polygonum angustifolium	•	•	•	•	50(++)
Aster serpentimontanus	•	•	•	•	50(++)
Astragalus fruticosus	•	•	•	•	50(--)
Lychnis sibirica	•	•	•	•	50(--)
Achyrophorus maculatus	•	•	•	•	50(--)
E0 - ground cryptogam layer					
Cladonia rangiferina	•	33(--)	33(22)	•	•
Ceratodon purpureus	•	•	33(22)	•	•
Cladina arbuscula	•	•	33(11)	•	•
Cetraria cucullata	•	•	33(++)	•	•
Rhytidium rugosum	•	•	•	•	50(11)

Appendix 5. Forest communities.

Synthetical relevé Nr.	36	37	38	39	40
Nr. of relevés synthetized	5	7	4	10	5
E3 - tree layer					
Pinus sylvestris	100(24)	100(44)	100(23)	10(11)	40(33)
Larix sibirica	100(23)	14(11)	50(22)	50(13)	•
Betula platyphylla	60(13)	14(11)	•	80(12)	•
Pinus sibirica	40(+1)	•	25(++)	100(+3)	100(23)
Abies sibirica	40(11)	•	•	10(++)	•
Populus tremula	40(11)	•	50(+1)	60(12)	20(11)
Betula pendula	•	14(11)	50(+1)	60(12)	20(11)
Betula pubescens	•	•	•	10(22)	•
E2 - shrub layer					
Rhododendron dauricum	100(14)	86(+3)	25(++)	•	•
Duschekia fruticosa	80(+2)	43(12)	25(22)	30(+1)	•
Pinus sibirica	40(+2)	43(11)	25(++)	70(+2)	•
Betula pendula	40(+2)	14(++)	50(22)	60(12)	•
Betula platyphylla	20(11)	14(++)	25(11)	70(12)	•
Pinus sylvestris	40(11)	29(12)	25(33)	20(+1)	•
Betula pubescens	•	•	•	40(12)	•
Padus avium	•	•	•	•	100(24)
Sorbus sibirica	20(++)	•	•	•	100(22)
Cotoneaster melanocarpus	•	•	•	•	80(+2)
Populus tremula	60(+1)	•	•	•	•
Salix caprea	40(+1)	•	•	20(+1)	•
Abies sibirica	20(22)	•	•	•	•
Pinus pumila	20(11)	29(+1)	•	20(+1)	40(+1)
Cotoneaster tjuliniae	20(++)	•	•	•	•
Larix sibirica	20(++)	•	25(11)	20(+1)	•
Rubus sachalinensis	20(++)	•	•	10(11)	•
Spiraea media	20(++)	•	•	•	•
Lonicera pallasii	20(++)	•	•	•	•
Spiraea salicifolia	20(++)	•	25(11)	10(++)	•
Ribes nigrum	•	•	•	10(11)	•
Salix hastata	•	•	•	10(11)	•
Crataegus sanguinea	•	•	•	•	40(++)
E1 - herb layer					
Calamagrostis obtusata	100(+3)	14(++)	•	•	•
Bergenia crassifolia	100(+1)	•	•	•	•
Linnaea borealis	80(12)	•	•	10(++)	•
Pyrola asarifolia	80(11)	•	•	10(--)	•

Mitella nuda	80(+1)	•	•	•	•
Ramischia secunda	80(-+)	•	•	•	•
Rubus saxatilis	60(+2)	•	•	•	•
Lycopodium complanatum	60(+1)	•	•	•	•
Galium boreale	60(++)	•	•	•	•
Trientalis europaea	60(++)	•	•	10(++)	•
Carex pediformis	40(11)	•	•	•	•
Phegopteris dryopteris	40(+1)	•	•	•	•
Geranium coeruleum	40(++)	•	•	•	•
Lilum martagon	40(++)	•	•	•	•
Solidago dahurica	40(++)	•	•	•	•
Vicia venosa	40(++)	•	•	•	•
Aconitum rubicundum	40(-+)	•	•	•	•
Aegopodium alpestre	40(-+)	•	•	•	•
Sanguisorba officinalis	40(-+)	•	•	•	•
Festuca ovina s.l.	•	100(+2)	•	•	20(++)
Empetrum sibiricum	•	86(+2)	25(++)	•	•
Carex ericetorum	•	43(++)	•	•	•
Pedicularis labradorica	•	29(++)	•	•	•
Pinus sylvestris juv.	•	29(++)	•	•	•
Antennaria dioica	•	29(-+)	•	•	•
Larix sibirica juv.	•	29(-+)	•	•	•
Carex canescens	•	•	75(14)	10(++)	•
Carex appendiculata	•	•	75(++)	•	•
Chamaedaphne calyculata	•	•	25(22)	90(12)	•
Oxycoccus palustris	•	•	•	80(+1)	•
Carex globularis	•	•	25(11)	70(+2)	•
Rubus chamaephorus	•	•	•	60(+2)	•
Smilacine trifolia	•	•	•	50(+2)	•
Glyceria spiculosa	•	•	•	50(-2)	•
Equisetum fluviatile	•	•	•	40(+1)	•
Oxycoccus microcarpus	•	•	•	40(+1)	•
Betula nana ssp. *rotundifolia*	•	•	•	30(+2)	•
Menyanthes trifoliata	•	•	•	30(+2)	•
Calamagrostis purpurea ssp. *langsdorffii*	•	•	•	30(+1)	•
Carex caespitosa	•	•	•	20(+1)	•
Drosera rotundifolia	•	•	•	20(++)	•
Eriophorum gracile	•	•	•	20(++)	•
Stellaria dichotoma	•	•	•	•	100(+1)
Festuca rubra ssp. *baicalensis*	•	•	•	•	80(12)
Silene repens	•	•	•	•	80(++)
Polygonatum odoratum	•	•	•	•	60(+1)
Leymus secalinus	•	•	•	•	60(++)
Polygonum baicalense	•	•	•	•	60(++)

Padus avium juv.	•	•	•	•	40(12)
Linaria acutiloba	•	•	•	•	40(-+)
Polygonum sericeum	•	•	•	•	40(-+)
Erysimum hieraciifolium	•	•	•	•	40(--)
Vaccinium uliginosum	•	14(11)	75(+1)	80(+2)	•
Calamagrostis neglecta	•	•	75(12)	30(+1)	•
Salix myrtilloides	•	•	50(++)	30(+1)	•
Comarum palustre	•	•	25(11)	30(++)	•
Carex limosa	•	•	25(++)	30(+1)	•
Carex capitata	•	•	25(11)	20(+1)	•
Epilobium palustre	•	•	25(++)	20(-+)	•
Rhodococcum vitis-idaea	80(13)	100(23)	25(11)	80(+1)	•
Ledum palustre	100(+3)	29(+2)	25(33)	100(24)	•
Rosa acicularis	100(+1)	71(++)	•	30(++)	100(11)
Maianthemum bifolium	100(11)	71(+1)	•	•	40(+1)
Calamagrostis epigeios	•	71(+2)	25(11)	•	60(+1)
Hieracium umbellatum	•	57(++)	•	•	60(+1)
Arctostaphylos uva-ursi	•	43(+2)	•	•	20(++)
Chamaerion angustifolium	80(+2)	14(--)	25(11)	20(-+)	20(11)
Pulsatilla patens	40(-+)	14(++)	•	•	•
Dactylorhiza fuchsii	40(-+)	14(--)	•	10(--)	•
Equisetum sylvaticum	20(22)	•	•	30(-1)	•
Lycopodium annotinum	20(22)	•	•	10(11)	•
Equisetum pratense	20(11)	•	•	•	•
Iris ruthenica	20(11)	•	•	•	•
Equisetum hiemale	20(++)	43(+1)	25(++)	•	•
Aegopodium alpestre	20(++)	•	•	•	•
Atragene sibirica	20(++)	•	•	•	•
Betula platyphylla juv.	20(++)	•	•	•	•
Cimicifuga foetida	20(++)	•	•	•	•
Duschekia fruticosa juv.	20(++)	•	•	•	•
Milium effusum	20(++)	•	•	•	•
Paris hexaphylla	20(++)	•	•	•	•
Pedicularis resupinata	20(++)	•	•	•	•
Rubus arcticus	20(++)	•	•	•	•
Viola brachysepala	20(++)	•	•	•	•
Abies sibirica juv.	20(--)	•	•	•	•
Aconitum septentrionale	20(--)	•	•	•	•
Cypripedium guttatum	20(--)	•	•	•	•
Epipogium aphyllum	20(--)	•	•	•	•
Goodyera repens	20(--)	•	•	•	•
Juniperus sibirica	20(--)	•	•	•	•
Thalictrum sp.	20(--)	•	•	•	•
Luzula palescens	•	29(-+)	25(--)	•	•
Rhododendron dauricum juv.	•	14(11)	•	•	•

Betula pendula juv.	•	14(++)	25(11)	•	•
Corallorhiza trifida	•	14(++)	•	•	•
Euphrasia stricta	•	14(++)	25(++)	•	•
Pinus sibirica juv.	•	14(++)	•	10(++)	•
Agrostis clavata	•	14(--)	25(++)	•	•
Campanula rotundifolia	•	14(--)	•	•	•
Spiraea salicifolia	•	14(--)	•	•	•
Carex rostrata	•	•	25(11)	•	•
Eriophorum russeolum	•	•	25(11)	•	•
Naumburgia thyrsiflora	•	•	25(++)	10(++)	•
Poa sibirica	•	•	25(--)	•	•
Carex dioica	•	•	•	10(++)	•
Carex lasiocarpa	•	•	•	10(++)	•
Carex paralella ssp. *redowskiana*	•	•	•	10(++)	•
Equisetum arvense	•	•	•	10(++)	•
Equisetum variegatum	•	•	•	10(++)	•
Galium uliginosum	•	•	•	10(++)	•
Lathyrus pratensis	•	•	•	10(++)	•
Peucedanum salinus	•	•	•	10(++)	•
Polygonum bistorta	•	•	•	10(++)	•
Pyrola rotundifolia	•	•	•	10(++)	•
Spiraea salicifolia	•	•	•	10(++)	•
Vicia cracca	•	•	•	10(++)	•
Aconitum longiracemosum	•	•	•	10(--)	•
Caltha sp.	•	•	•	10(--)	•
Lathyrus pilosus	•	•	•	10(--)	20(--)
Stachys aspera	•	•	•	10(--)	•
Sorbus sibirica juv.	•	•	•	•	20(22)
Elytrigia repens	•	•	•	•	20(++)
Galium verum	•	•	•	•	20(++)
Isatis oblongata	•	•	•	•	20(++)
Allium splendens	•	•	•	•	20(--)
Lappula myosotis	•	•	•	•	20(--)
E0 - ground cryprogam layer					
Ptilium crista-castrensis	80(+2)	•	•	•	20(11)
Cladina arbuscula	•	86(+2)	25(22)	10(++	20(++)
Cladina rangiferina	•	71(13)	25(11)	10(11)	•
Cladonia cervicornis	•	57(-+)	•	•	•
Polytrichum piliferum	•	43(-+)	•	•	•
Sphagnum sect. *Cuspidata*	•	•	25(++)	80(14)	•
Sphagnum rubellum	•	•	•	80(12)	•
Sphagnum magellanicum	•	•	•	60(+4)	•
Helodium blandowii	•	•	•	30(+1)	•
Drepanocladus uncinatus	•	•	•	•	60(+2)

Dicranum polysetum	60(+1)	86(12)	50(22)	•	40(22)
Cladina stellaris	20(++)	86(+2)	50(11)	50(+1)	•
Pleurozium schreberi	100(24)	86(13)	75(23)	30(12)	100(+2)
Aulacomnium palustre	20(11)	•	50(+1)	40(+2)	•
Polytrichum commune	20(22)	•	75(12)	20(22)	•
Polytrichum juniperinum	20(22)	43(+1)	•	10(11)	•
Brachythecium salebrosum	20(11)	•	•	•	•
Cladonia amaurocraea	20(++)	29(22)	•	•	20(++)
Ptilidium pulcherrimum	20(++)	14(++)	•	•	20(++)
Polytrichum strictum	20(++)	•	•	20(-1)	•
Peltigera malacea	•	29(++)	25(++)	10(++)	•
Dicranum fuscescens	•	14(22)	•	•	•
Certaria islandica	•	14(++)	•	•	•
Aulacomnium acuminatum	•	14(11)	•	•	•
Paludella squarrosa	•	•	25(22)	10(22)	•
Sphagnum squarrosum	•	•	25(22)	•	•
Sphagnum nemoreum	•	•	25(11)	10(22)	•
Sphagnum wulfianum	•	•	•	20(22)	•
Tomenthypnum nitens	•	•	•	20(+2)	•
Sphagnum russowii	•	•	•	10(33)	•
Sphagnum fuscum	•	•	•	10(22)	•
Calliergon stramineum	•	•	•	10(11)	•
Rhizomnium magniferum	•	•	•	10(++)	•
Ceratodon purpureus	•	•	•	•	20(11)

Appendix 6. Subruderal and ruderal communities.

Synthetical relevé Nr.	**41**	**42**	**43**	**44**	**45**
Nr. of relevés synthetized	3	3	4	1	1
Carex bohemica	100(34)	•	•	•	•
Juncus alpino-articulatus	100(12)	•	•	•	•
Ranunculus reptans	100(-+)	•	•	•	•
Plantago depressa	•	100(+2)	•	•	•
Rorippa palustris	•	100(+1)	25(++)	•	•
Ranunculus sceleratus	•	100(+1)	25(++)	•	•
Polygonum minor	•	•	75(22)	•	•
Scirpus tabernaemontani	•	•	75(-+)	•	•
Triglochin maritima	•	•	50(-+)	•	•
Urtica cannabina	•	•	•	100(44)	•
Artemisia vulgaris	•	•	•	100(11)	•
Urtica dioica	•	•	•	100(11)	•

Cirsium setosum	•	•	•	100(11)	•
Lamium album	•	•	•	100(++)	•
Chenopodium album	•	•	•	100(++)	•
Descurainia sophia	•	•	•	100(++)	•
Trifolium repens	•	•	•	•	100(++)
Agrostis clavata	•	•	•	•	100(++)
Matricaria discoidea	•	•	•	•	100(22)
Polygonum aviculare s.l.	•	•	•	•	100(33)
Hordeum jubatum	•	•	•	•	100(++)
Capsella bursa-pastoris	•	•	•	•	100(++)
Juncus bufonius s.l.	100(+2)	100(34)	50(12)	•	•
Eleocharis klingei	67(++)	67(++)	•	•	•
Callitriche palustris	33(--)	•	•	•	•
Potentilla anserina	•	100(12)	50(13)	•	•
Polygonum lapathifolium	•	100(-+)	25(11)	•	100(++)
Triglochin palustre	•	67(-+)	100(23)	•	•
Plantago major	•	67(-+)	•	•	100(11)
Inula britannica	•	33(++)	50(-2)	•	•
Bidens radiata	•	•	25(11)	•	•
Puccinelia tenuiflora	•	•	25(++)	•	•
Chenopodium glaucum	•	•	25(++)	•	•

CONCLUDING REMARKS

Ecology of the Svjatoj Nos wetlands, Lake Baikal.
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THE SVJATOJ NOS WETLANDS: ECOLOGY AND CONSERVATION

J. Mlíkovský[1], P. Stýblo[2]

[1]Department of Evolutionary Biology, Czechoslovak Academy of Sciences,
Sekaninova 28, CS-128 00 Praha 2, Czechoslovakia.
[2]Nádražní 314, CS-262 31 Milín, Czechoslovakia.

Introduction

The results of the field-work of the Svjatoj Nos 1991 expedition to the Svjatoj Nos wetlands in north-central Baikal were summarized in preceding chapters of this monograph. It was shown, among other things, that the Svjatoj Nos wetlands are inhabited by a number of vertebrate species included in the Red Data Book of Buryatia (Pronin 1988). In the present chapter, an attempt will be made to evaluate the current ecological status of the wetlands and its conservational value.

The network of Siberian wetlands

On a large scale, Siberia appears almost uniform, being composed of vast forests, split by rivers. This is also the usual interpretation of Siberian nature in both scientific and popular literature. However, Siberia is in reality a coarse-grained mosaic of lowland or mountain tundra, forests, and lowland wetlands. The scale of the mosaic changes locally. An important implication of this distribution of habitats is that animal and plant populations are not continuous, as it would appear from generalized distribution maps of individual species, but patchy (cf. Romanov 1988).

In the wider vicinity of Lake Baikal patches of tundra, forests and wetlands are of rather limited size. The mountains reach approximately 1700-2500 m a.s.l. Tundra is present, roughly estimated, in altitudes above 1500 m. Wetlands are located in lowlands, i.e. in altitudes of approximately 400-600 m. The wetlands occur along larger rivers and on the coast of Lake Baikal. Small wetlands are numerous, but only few can be regarded as important (Fig. 1). These include the wetlands (1) along the Verchnjaja Angara river in the Verchneangarskaja basin, (2) in the northernmost corner of Lake Baikal, i.e in the common estuary of rivers Cholodnaja, Kičera, Verchnjaja Angara and Verchnjaja Akuli, (3) along the Barguzin river in the Barguzinskaja basin, (4) along the Cipa river in the Cipinskaja basin, (5) on the Svjatoj Nos isthmus, and (6) in the Selenga delta. Only three of these wetlands can serve as stopovers for waterbirds migrating along Lake Baikal: (a) common estuary of several rivers in northernmost Baikal (Nr. 2), (b) Svjatoj Nos wetlands in north-central Baikal (Nr. 5), and (c) estuary of Selenga river in south-central Baikal (Nr. 6). The direct distance between northernmost Baikal and Svjatoj Nos is approximately 250 km; the Selenga estuary is a further 200-250 km to the south. Of these wetlands, only those of the Selenga delta were included among the "very important" wetlands of the Russian Federation (Vinogradov 1988, see also Skokova and Vinogradov 1986), although Gusev (1959) and Moložnikov (1974a) had already pointed out the importance of the Svjatoj Nos wetlands and called for their protection.

The Svjatoj Nos wetlands as an ecosystem

A necessary condition for further evaluation of the ecological status and conservation value of the Svjatoj Nos wetlands is an estimation of the degree to which it is closed or open to its vicinity.

In general, its position in the network of Siberian wetlands makes it probable that the Svjatoj Nos wetlands are rather separated from the neighboring habitats. The nearest wetlands are located in the Barguzinskaja basin along the Barguzin river, approximately 40 km NE from the Svjatoj Nos wetlands. Both these wetlands form a single zoogeographical unit according to earlier authors (Gagina 1960, 1961, Švecov et al. 1975, Ljamkin 1977), but the differences in species composition may be more pronounced than formerly assumed (cf. e.g. Lípa and Reiter 1992). Nonetheless, ecological connections of the Svjatoj Nos wetlands are numerous. They will be briefly discussed below.

(1) Several species of fish inhabiting open Lake Baikal visit Lake Arangatuj to reproduce in it or in nearby creeks (Kožov 1962). These fish, both adult and young, probably form an important food resource for various waterbirds, but adequate ecological analysis is absent thus far.

(2) Since the Istok river which connects Lake Arangatuj with Lake Baikal became widened in 1962 after the water level of Lake Baikal rose due to the finished Irkutsk dam, Baikal seals visit Lake Arangatuj each autumn in great numbers (Pastuchov 1977). Their ecological role, however, is unknown as yet.

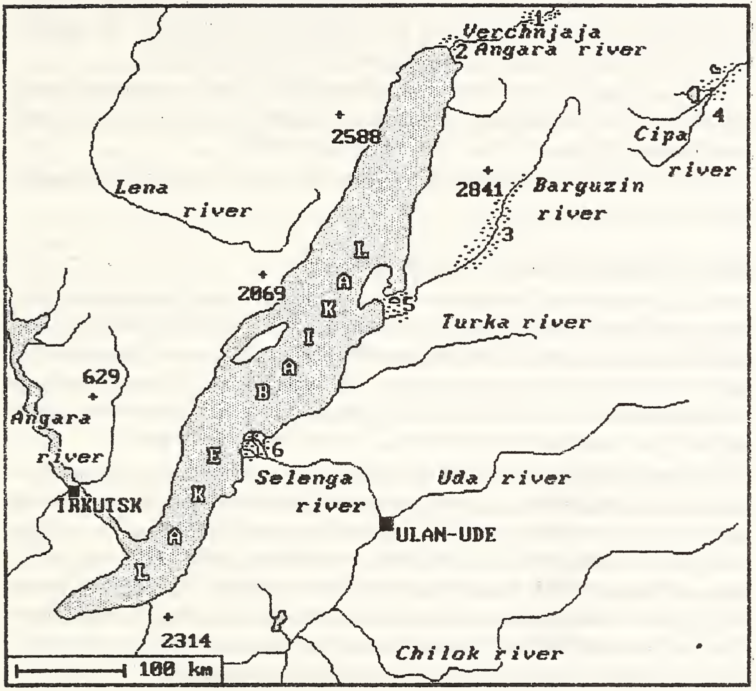

Fig. 1. Large wetlands in the vicinity of Lake Baikal. Numbers refer to those in text.

(3) Forest and tundra birds from the wider vicinity of the Svjatoj Nos wetlands visit the area in late summer during pre-migration wanderings (see Heyrovský et al. 1992).

(4) The Svjatoj Nos wetlands are apparently an important stop-over for migrating waterbirds (see Heyrovský et al. 1992).

(5) One bird species, the Willow Grouse *Lagopus lagopus*, does not breed in the Svjatoj Nos wetlands, but winters in the area (Skrjabin and Filonov 1962).

(6) Large mammals, such as elks *Alces alces*, irregularly visit the area (cf. Lípa and Reiter 1992).

(7) Birds breeding in the Svjatoj Nos wetlands only rarely feed outside the area in the Barguzinskij or Čivyrkujskij Bays. These include divers (*Gavia* spp.), gulls (*Larus* spp.) and more rarely sterns of the genera *Sterna* and *Chlidonias* (J. Mlíkovský, unpub. observations).

(8) Brown bears *Ursus arctos* and Silver Gulls *Larus argentatus* do not reproduce in the Svjatoj Nos wetlands, but regularly visit the area to feed there (Heyrovský et al. 1992, Lípa and Reiter 1992).

(9) The ecological relations of invertebrates of the Svjatoj Nos wetlands have not been described as yet.

Rare vertebrates of the Svjatoj Nos wetlands

Overall, 38 species of vertebrates listed in the Red Data Book of Buryatia were registered in the Svjatoj Nos wetlands. They include one fish, one amphibian, one reptile, 31 avian, and 4 mammalian species (Appendix 1). Some of these species became extinct in the area (e.g. Great Cormorant *Phalacrocorax carbo*, Swan Goose *Anser cygnoides*), while others were probably just vagrants to the area (e.g. Azure Tit *Parus cyanus*).

The estimated importance of the Svjatoj Nos wetlands for the survival of individual endangered species and their population trends are given in Appendix 1. For more detailed data on these and other species see the group reports of the Svjatoj Nos 1991 expedition (Heyrovský et al. 1992, Lípa and Reiter 1992, Samek and Samková 1992a,b). As outlined there, our results were sometimes at variance with the data from the Red Data Book of Buryatia and it is probable that further research in Buryatia will lead to a modification of the list of vertebrates included in it.

Potential enemies to the Svjatoj Nos wetlands

Human population

The local inhabitants are very few and concentrated in four small villages. Of them, Kurbulik, Monachovo and Katun' are located on the shore of the Čivyrkujskij Bay, while Makarovo is on the shore of the Barguzinskij Bay. The current overall population is approximately 150 people, including 60 children (V.S. Meľnikov, pers. communication). The population has sharply decreased during the last few years, because the prohibition of hunting in the Park made the survival of the people difficult (cf. Kiselev 1988). Till now, the villages Glinka and Čivyrkuj have been abandoned, and the process is continuing. It can thus be expected that the Svjatoj Nos isthmus will be without resident inhabitants in the near future. It is not uninteresting in this respect that the human population is also decreasing elsewhere in the coastal region of NE Baikal (Misevič and Lukjanov 1976).

Hunting and poaching

Local inhabitants have been mainly hunters and fishers. Their activities resulted in a decrease in population size of all the large mammals and the most commercially important fur-bearing mammals (Gusev 1961, Anaškin 1962, Labov 1966, Gagina and Skalon 1973, Moložnikov 1974b, Monachov 1974, Smirnov 1975, Černojarova 1976, Moskvitin and Atutov 1985). The distribution of these animals is now usually patchy and represents only minor parts of the past distribution in the region.

In the Svjatoj Nos peninsula, all large mammals now occur only as vagrants (Moložnikov 1970), with the possible exception of bears (see Lípa and Reiter 1992). The population of elks in the Zabajkaľskij National Park is currently increasing (V.S. Meľnikov, pers. communication) and their recolonization of the Svjatoj Nos wetlands is possible. Fur-bearing animals are rare or absent from the Svjatoj Nos isthmus (Lípa and Reiter 1992). Elsewhere in the Zabajkaľskij National Park the population of the sable *Martes zibellina* is increasing (V.S. Meľnikov, pers. communication).

As regards birds, Siberian hunters focus on waterfowl (geese and ducks) and coots *Fulica atra*. Populations of waterfowl species are now known to decrease in Siberia (Gusakov 1988). Population sizes of waterfowl species in the Svjatoj Nos wetlands have never been estimated, so that the impact of hunters is unknown. However, coots are said to have been exterminated by hunters in the late 1950s/early 1960s (see Heyrovský et al. 1992). Waterfowl hunting is prohibited in the Park.

Fishing is still allowed in the Park and is used by local inhabitants for both their own needs and commercial use. No fishing is done directly in the wetlands, however, and fish populations of the Lake Arangatuj are closely connected with those in Lake Baikal (Kožov 1962), so that no particular conservation measures devised for the fish fauna are currently needed in the Park.

Because all hunting activities, except fishing to some degree, are prohibited in the Park, only poachers are now of danger to the fauna of the Svjatoj Nos wetlands. The degree of danger is low, however, because large mammals have already been exterminated in the region (Moložnikov 1970) and the impact of poachers on duck populations can hardly be strong enough to influence their numbers. On the other hand, local hunters and poachers do not distinguish between duck species (Gusakov 1988), so that ducks protected by law will be shot.

Agriculture and farming

There are almost no agricultural activities in the Svjatoj Nos isthmus. Only in August and early September local inhabitants mow grass in wetlands for commercial use (for animal farms outside the Park). In general, this activity can hardly have a marked negative influence on the Svjatoj Nos wetlands, but particularly shy birds, such as Hooded Cranes *Grus monacha* can be flushed.

Similarly, farming will have no negative effect on the Svjatoj Nos wetlands. In fact, there is only one farmer with approximately 200 cattle based at Kulinoe. In winter, he leaves the area with his animals. We could not observe any important inferences between these cattle and wild animals or birds. Potentially greater problem present feral mammals which are recruited from domestic stock (see below).

Tourism

Lake Baikal is visited by approximately 400 000 tourists each year (Imetchenov 1990). Most of them live in tourist centers, which are absent from the Zabajkal'skij National Park. The Svjatoj Nos isthmus is currently visited by two kinds of tourists. A certain proportion of them camp in tents on the narrow sandy shores of the Barguzinskij Bay. These tourists only exceptionally cross the sandy dunes to the proper Svjatoj Nos wetlands. Their negative impact on the nature is negligible, because (1) there is a lot of floated wood on the shore which can be used as firewood; (2) plastics are less common in Buryatia, so that most of the rubbish (which is generally small) is from quickly dissipating materials, such as paper; (3) the shore of the Barguzinskij Bay is of minor importance to animals in the Park, so that no real disturbances occur.

The remaining tourists are alpinists, who just cross the Svjatoj Nos isthmus to enter the hill range in the Svjatoj Nos peninsula. They have no impact on the Svjatoj Nos wetlands.

The numbers of tourists are generally very low, particularly because there are no public utilities in the Svjatoj Nos isthmus and peninsula, and because managers of the Park made only limited attempts to advertise the natural beauties of the Park, so that it is almost unknown. The situation might change, however, because managers of the Park plan to attract more tourists to the Park and BAIKALINVEST, a Russian-Belgian company, will build a small hotel at Glinka in 1992. The real impact of this action on the Svjatoj Nos wetlands cannot be foreseen in the absence of other data.

Traffic

There is only one sandy road crossing the Svjatoj Nos isthmus. It is located on the sandy dunes which border the Barguzinskij Bay. At Glinka it splits to a southern and a northern branch, which lead between mountains of the Svjatoj Nos peninsula and bay shores or wetlands, respectively.

The traffic is low. In July and August 1991, the road near our base camp in Kedrovka was used by some 2-20 cars per day in each direction.

Pollution

No proper data are available. Nonetheless, there are no factories in the vicinity of the Svjatoj Nos isthmus and both towns (Usť-Barguzin and Barguzin), which potentially could produce some pollutants, lay on the Barguzin river which empties into the Barguzinskij Bay, thus avoiding the Svjatoj Nos wetlands. Also, no damage of trees was observed. It seems probable that pollution is not at present a problem for the Svjatoj Nos wetlands.

Feral and introduced mammals

Several dozen cattle, two bands of horses and a few dogs were the only feral animals observed by us in the Svjatoj Nos wetlands (Lípa and Reiter 1992). They obviously influenced portions of vegetation in the area (cf. Chytrý and Pešout 1992), but nothing is known about their potential direct influence on the wild vertebrates. Nuchimovskaja and Bibikova (1983) pointed out that cattle can bring parasites to reserves. However, parasitological research has not been conducted in the Svjatoj Nos wetlands yet.

Introducing vertebrates has always been common practice in the (former) Soviet Union (Lavrov 1949). Fortunately, the only non-native vertebrate species introduced to the Svjatoj Nos wetlands was the Muskrat *Ondatra zibethicus*. It was released in 1936 (Moložnikov 1974b) and developed a large population, of which approximately 2000 individuals are now hunted each year (see Lípa and Reiter 1992). In the absence of earlier data the possible influence of muskrats on the ecosystem of the Svjatoj Nos wetlands cannot be evaluated.

Forest fires

Forest fires are a common phenomenon in Siberia (Kurbatskij 1964, Furjaev and Kireev 1979), not escaping the reserves (Bibikova and Šalenkova 1988). In the Svjatoj Nos wetlands, large proportion of forests, which died due to the raised water level in Lake Baikal in 1962, were found by us in 1991 to be burned. The ground vegetation of these burned taiga patches was turning towards a marshy one (see Chytrý and Pešout 1992). Arboreal vertebrates were almost absent from these patches; only European Nuthatches *Sitta europaea*, Brown Shrikes *Lanius cristatus*, and Siberian Jays *Perisoreus infaustus* were observed visiting them (J. Mlíkovský, unpub. observations). Forest fires apparently have significant, though a less studied influence on the vertebrate life in Siberia (Kozlenko 1988).

Law protection of the Svjatoj Nos wetlands

The first project aimed at protecting southern shore of the Čivyrkujskij Bay and adjacent part of the Svjatoj Nos wetlands was presented in 1974, but was not accepted by the government. Only on 12 September 1986, the Cabinet of Ministers of the Russian Soviet Federative Socialist Republic published its decree No. 401 which supported the conservation of nature in the Baikal basin. On the basis of that decree, the Cabinet of Ministers of the Buryat Autonomous Soviet Socialist Republic (which has been part of the Russian Federation) published on 14 June 1991 its decree No. 123 by which the Zabajkal'skij National Park was founded. This park (2.691 km^2) includes the entire Svjatoj Nos wetlands and adjacent parts of the Čivyrkujskij Bay (270 km^2) and the Barguzinskij Bay (100 km^2), plus Uškan' i Islands, the Svjatoj Nos peninsula, islands in the Čivyrkujskij Bay, and southern part of the Barguzinskij Range (Fig. 1). Law protection of national parks in the Russian Federation has been the same as elsewhere (Zabelina 1987). The overall conservation of Lake Baikal and its vicinity is complex (Malikov 1987).

The conservation in the Park is realized by the State inspection of nature conservation, headed by the director of the Park. The vast area and small numbers of respective inspectors make, however, the application of the laws less effective (see also Belkova 1981, 1986).

Suggestions for conservation measures

Propagation

The results of the field-work of the 1991 Svjatoj Nos expedition to the Svjatoj Nos wetlands in north-central Baikal were summarized in preceding chapters of this monograph. It was shown, among other things, that the Svjatoj Nos wetlands are inhabited by a number of vertebrate species included in the Red Data Book of Buryatia (Pronin 1988). In the present chapter, an attempt will be made to evaluate the current ecological status of the wetlands and its conservational value.

Posters introducing rare animals and plants of the Zabajkal'skij National Park to the visitors are absent at present, but are planned to be installed.

Research in the Zabajkal'skij National Park

There are no scientists based in the Zabajkal'skij National Park. The research, coordinated by a vice-director of the Park, has been done by scientists from the Buryat Scientific Center of the Siberian Branch of the (then) USSR Academy of Sciences (Tulochonov and Doržiev 1990) and by the 1991 Svjatoj Nos expedition (this volume). This made a valuable basis for park management, but much more research has to be done because portions of the Park have never been visited by scientists as yet, and some animal groups, such as all invertebrates, have not been adequately studied in the Park as yet. Moreover, population trends of most vertebrate and plant species, common or rare, are unknown. The population status of all rare species should be regularly monitored.

Financial support

The bad economical situation in the Russian Federation, including Buryatia, makes any adequate development of the Zabajkal'skij National Park hardly possible without support from foreign organizations. Several ecological organizations were already created in Buryatia aimed officially at gathering money to promote the conservation of Lake Baikal, including the Zabajkal'skij National Park. However, their professional status is uncertain and a real danger exists that these organizations will take more care of their members' profit than of Baikal's nature. Western organizations have recently shown more interest in Baikal than earlier, but similarly, although speaking much of ecology and conservation, they probably have more commercial interests. It would be thus desirable, that internationally renowned conservation institutions try to help local managers to organize the conservation of Lake Baikal before its nature is destroyed by selfish commercial organizations.

Summary

(1) The Svjatoj Nos wetlands are an important locality of water and marsh birds, that is inhabited by numerous species included in the Red Data Book of Buryatia.

(2) The current law protection of the wetlands appears sufficient in general, as it is part of the Zabajkal'skij National Park.

(3) The human impact on the Svjatoj Nos wetlands is negligible at present.

(4) First botanical and zoological research in the Svjatoj Nos wetlands has been done, but invertebrates remain unknown and population trends of many of the rare animals and plants could not be estimated yet, due to the absence of earlier comparable data.

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Appendix

List of vertebrate species occurring in the Svjatoj Nos wetlands, which are included in the Red Data Books of the (former) Soviet Union (A) and Buryatia (B). C = estimated conservation value of the Svjatoj Nos wetlands. D = population trends in the Svjatoj Nos wetlands.

Species	A	B	C	D
Mammalia				
Myotis daubentoni	-	3	++	?
Plecotus auritus	-	3	++	?
Eptesicus nilssoni	-	3	+	?

Phalacrocorax carbo	-	1	-	E
Botaurus stellaris	-	3	?	-
Ciconia nigra	2	2	+	?
Cygnus cygnus	-	2	++	-
Anser cygnoides	-	1	-	E
Anas falcata	-	3	+	-
Anas poecilorhyncha	-	3	+	-
Histrionicus histrionicus	-	4	-	E
Melanitta fusca	-	3	++	0
Haliaeetus leucoryphus	1	1	++	+
Haliaeetus albicilla	2	2	++	0
Aquila clanga	-	2	++	?
Aquila chrysaetos	2	2	++	?
Pandion haliaetus	3	2	++	?
Falco subbuteo	-	3	++	?
Falco cherrug	3	2	+	?
Falco peregrinus	2	2	+	?
Coturnix japonica	-	3	+	-
Porzana pusilla	-	3	++	?
Grus monacha	3	1	++	?
Otis tarda	-	1	-	E
Limnodromus semipalmatus	4	3	++	+
Numenius minutus	3	4	+	?
Bubo bubo	-	1	+	?
Surnia ulula	-	3	+	?
Aegolius funereus	-	3	+	?
Dendrocopos minor	-	3	+	?
Zoothera dauma	-	4	+	?
Locustella fasciolata	-	3	+	E
Parus cyanus	-	4	-	E
Certhia familiaris	-	2	++	+
Reptilia				
Natrix natrix	-	2	++	0
Amphibia				
Rana arvalis	-	3	++	?
Pisces				
Acipenser baeri	-	2	?	?

A-B: Status of endangered species in the (former) USSR (Borodin 1984) and in Buryatia (Pronin 1988), respectively. 1 - Endangered, disappearing species, whose conservation is impossible without special help. 2 - Species, whose population numbers are dramatically declining. 3 - Rare species. 4 - Less known species, which -- if better known -- could probably be assigned to one of the former three categories. 5 - Recovered species, now out of danger of extinction, nonetheless still in need of control.

C: Estimated conservation value of the Svjatoj Nos wetlands for individual species: ++ great, + small or potential, - no.

D: Population trends: + increasing, 0 stable, - decreasing, E = extinct, ? unknown. Admittedly, the estimations are very rough, because data by earlier authors are mostly difficult to interpret.

Index of plant genera

Abies - 154, 212, 214
Achillea - 172, 210
Achyrophorus - 173, 211
Aconitum - 163, 213-215
Aegopodium - 213, 214
Agropyron - 157, 210
Agrostis - 155, 208, 215, 217
Alisma - 189, 207
Allium - 159, 211, 215
Alopecurus - 155
Amblynotus - 170
Amblystegium - 207
Andromeda - 168, 190, 207
Androsace - 169
Antennaria - 172, 213
Arctostaphylos - 169, 214
Artemisia - 172, 173, 191, 194, 202, 210, 216
Aster - 152, 172, 211
Astragalus - 166, 211
Atragene - 163, 214
Aulacomnium - 190, 209, 216
Axyris - 162
Baeothryon - 157, 207
Batrachium - 163, 186, 187, 198
Beckmannia - 156, 208
Bergenia - 212
Betula - 161, 190, 192, 193, 201, 202, 207-209, 212-215
Bidens - 172, 188, 194, 206, 217
Brachythecium - 216
Brassica - 164
Bromopsis - 157, 211
Bromus - 211
Bupleurum - 168, 210
Calamagrostis - 155, 156, 188, 189, 193, 196-198, 200, 206, 208, 210, 212-214
Calla - 159, 189, 198, 206
Calliergon - 210, 216
Callitriche - 167, 186, 193, 205, 217
Caltha - 163, 215
Campanula - 172, 215
Capsella - 164, 217
Cardamine - 164, 207
Carex - 152, 158, 159, 187-193, 196-198, 200-202, 205-208, 210, 211, 213-216
Cerastium - 162
Ceratodon - 191, 209, 211, 216
Ceratophyllum - 163, 185, 186, 205
Cetraria - 210, 211, 216
Chamaedaphne - 168, 190, 193, 200, 201, 207, 213
Chamaenerion - 167, 214
Chelidonium - 164
Chenopodium - 162, 217
Cicuta - 168, 208
Cimicifuga - 214
Cirsium - 194, 217
Cladina - 209, 211, 215, 216
Cladonia - 192, 209, 211, 215, 216
Comarum - 165, 187-190, 198, 206, 208, 214
Corallorhiza - 160, 209, 215
Corispermum - 162, 173, 211
Cotoneaster - 165, 211, 212
Craniospermum - 170, 173, 191, 197, 210
Crataegus - 165, 212
Crepis - 173
Cypripedium - 214
Dactylorhiza - 160, 209, 214
Delphinium - 163, 211
Dendranthemum - 172
Descurainia - 164, 217
Dianthus - 163, 210
Dicranum - 192, 216

Diphasium - 154
Draba - 164
Dracocephalum - 170
Drepanocladus - 190, 209, 215
Drosera - 164, 208, 209, 214
Duschekia - 161, 192, 212, 214
Eleocharis - 157, 158, 177-180, 188, 189, 198, 206, 207, 217
Elymus - 157
Elytrigia - 157, 215
Empetrum - 167, 213
Epilobium - 167, 187, 206, 208, 214
Epipogium - 214
Equisetum - 153, 188, 206, 208, 209, 213-215
Erigeron - 172
Eriophorum - 157, 190, 208, 213, 215
Erysimum - 164, 214
Euphrasia - 170, 208, 215
Festuca - 156, 157, 173, 191, 192, 197, 210, 213
Filipendula - 166, 206
Galatella - 172
Galeopsis - 170
Galium - 171, 206, 208-210, 213, 215
Gentiana - 169, 170
Geranium - 167, 213
Geum - 166
Glyceria - 156, 190, 208, 213
Goodyera - 214
Gymnocarpium - 153
Halerpestes - 163
Hammarbya - 160, 209
Helictotrichon - 156, 210
Helodium - 210, 215
Herminium - 160, 209
Heteropappus - 172, 210
Hieracium - 173, 210, 214
Hippuris - 167, 188, 189, 198, 206
Hordeum - 157, 194, 217
Hylotelephium - 152
Icmadophila - 209
Inula - 172, 206, 217
Iris - 160, 173, 206, 208, 214
Isatis - 164, 191, 210, 215
Juncus - 159, 193, 194, 216, 217
Juniperus - 214
Koeleria - 156, 210
Lactuca - 173, 206
Lamium - 170, 194, 217
Lappula - 170, 215
Larix - 154, 192, 193, 200-202, 212, 213
Lathyrus - 166, 206, 215
Ledum - 168, 190, 192, 193, 207, 209, 214
Lemna - 159, 184-189, 205, 106, 108
Leptobryum - 207
Leptodictyum - 209
Leucanthemum - 172
Leymus - 157, 191, 197, 210, 213
Lilium - 173, 213
Linaria - 170, 214
Linnaea - 171, 212
Lonicera - 212
Luzula - 159, 214
Lychnis - 163, 211
Lycopodium - 153, 213, 214
Maianthemum - 160, 193, 214
Matricaria - 172, 194, 217
Meesia - 209
Melandrium - 163
Melica - 156
Menyanthes - 169, 187, 189, 190, 197, 198, 200, 206, 208, 213
Milium - 214
Mitella - 165, 213
Moehringia - 162, 209
Myosotis - 170
Myriophyllum - 167, 185-187, 205, 206

Naumburgia - 169, 189, 198, 207, 208, 215
Nymphaea - 163, 174, 185, 186, 205, 206
Nymphoides - 169
Ophioglossum - 153
Orobanche - 171
Orostachys - 165, 210
Orthilia - 168
Oxycoccus - 169, 190, 201, 208, 213
Oxytropis - 166, 210
Padus - 166, 174, 193, 197, 212, 214
Paludella - 209, 216
Papaver - 164, 191, 197, 210, 211
Paris - 160, 214
Parnassia - 165
Pedicularis - 171, 206, 208, 209, 213, 214
Peltigera - 216
Peucedanum - 168, 208, 215
Phalaroides - 155
Phegopteris - 213
Phleum - 155
Phlojodicarpus - 168, 173, 210
Phlomis - 170, 211
Phragmites - 156, 187, 200
Pinus - 80, 154, 190, 192, 193, 197, 198, 200-202, 205-207, 209, 211-213, 215
Plantago - 171, 193, 194, 211, 216, 217
Pleurozium - 192, 193, 216
Poa - 156, 206, 209, 210, 215
Polemonium - 169
Polygala - 167, 211
Polygonatum - 160, 205
Polygonum - 161, 162, 173, 185, 191, 194, 200, 205, 206, 208, 210, 211, 213-217
Polypodium - 153
Polytrichum - 193, 209, 215, 216
Populus - 160, 192, 202, 212
Potamogeton - 154, 155, 185-187, 198, 205, 206
Potentilla - 165, 166, 191, 194, 202, 207, 208, 210, 217
Pteridium - 153
Ptilidium - 216
Ptilium - 215
Puccinelia - 156, 217
Pulsatilla - 152, 163, 210, 214
Pyrola - 168, 207, 212, 215
Ramischia - 213
Ranunculus - 163, 188, 189, 193, 205-207, 216
Rhinanthus - 170
Rhizomnium - 209, 216
Rhodococcum - 169, 192, 197, 198, 210, 214
Rhododendron - 168, 174, 192, 212, 214
Rhytidium - 211
Ribes - 165, 212
Rorippa - 164, 194
Rosa - 166, 191, 193, 197, 206, 208, 210, 214, 216
Rubus - 165, 190, 207, 212-214
Rumex - 161, 188, 206, 208
Sagina - 162
Sagittaria - 155
Salix - 160, 208, 212, 214
Sanguisorba - 166, 213
Saxifraga - 165, 209
Scheuchzeria - 155, 209
Schizonepeta - 170, 192, 202, 211
Scirpus - 157, 187, 188, 194, 200, 206, 216
Scolochloa - 156, 208
Scorzonera - 173, 210
Scrophularia - 170, 191, 210
Sedum - 165
Selaginella - 154
Senecio - 173, 188, 194
Setaria - 155

Silene - 162, 211, 213
Sium - 168
Smilacine - 159, 208, 213
Solidago - 172, 213
Sorbus - 165, 193, 212, 215
Sparganium - 154, 185-189, 198, 205, 206
Sphagnum - 190, 193, 201, 209, 215, 216
Spiraea - 165, 207, 212, 215
Spiranthes - 160, 209
Spirodella - 158, 185, 187, 205, 206, 208
Stachys - 170, 188, 208, 215
Stellaria - 162, 191, 193, 197, 210, 213
Swida - 168
Taraxacum - 173
Thalictrum - 164, 214
Thelypteris - 153, 174
Thymus - 170, 173, 191
Tomenthypnum - 190, 201, 209, 216
Trientalis - 169, 213
Trifolium - 166, 210, 217
Triglochin - 155, 188, 190, 194, 200, 201, 207, 208, 216, 217
Typha - 154
Urtica - 161, 194, 216
Utricularia - 171, 185, 187-190, 189, 205-207
Vaccinium - 169, 192, 193, 207, 214
Valeriana - 172
Veronica - 170, 211
Vicia - 166, 210, 213-215
Viola - 167
Woodsia - 153
Youngia - 173

Index of animal genera

Accipiter - 42, 71
Acipenser - 85, 137, 138
Acrocephalus - 55, 74, 95, 99
Actitis - 49, 72
Aegithalos - 56, 74
Aegolius - 51, 73
Agkistrodon - 119, 123, 124
Alauda - 52, 73
Alcedo - 52, 73
Alces - 109, 112, 223
Anas - 39, 40, 59, 60, 71, 82, 85
Anser - 38, 39, 71, 85, 224
Anthus - 53, 59, 73, 93, 98
Apodemus - 105, 109, 110, 112, 114
Apus - 51, 73
Aquila - 43, 60, 71
Ardea - 38, 70, 82, 85
Arenaria - 49, 72
Arvicola - 84, 85
Aythya - 40, 60, 71, 82, 85
Bombycilla - 53, 73
Bonasa - 44, 71
Bos - 20, 110, 112
Botaurus - 38, 60, 70
Bubo - 51, 73, 107
Bucephala - 41, 71
Buteo - 42, 71
Calidris - 46, 72
Canis - 110, 112
Capreolus - 109, 112
Carassius - 82, 84, 85, 138
Carduelis - 58, 59, 74
Carpodacus - 58, 74, 96, 100
Certhia - 56, 74
Charadrius - 45, 72
Chlidonias - 50, 59, 73, 224
Ciconia - 38, 60, 70
Circus - 42, 71
Citellus - 84
Clethrionomys - 105, 109, 110, 112-114
Coccothraustes - 58, 74
Columba - 51, 73
Coregonus - 138
Corvus - 57, 74, 85, 96, 100
Coturnicops - 18, 44, 60, 72
Coturnix - 44, 72
Cricetulus - 113
Cuculus - 51, 73
Cyanopica - 57, 74
Cygnus - 38, 60, 71
Cyprinus - 138
Delichon - 53, 73
Dendrocopos - 52, 73
Dryocopus - 52, 73
Elaphe - 124
Emberiza - 58, 59, 74, 89-92, 96, 97, 100, 101
Eptesicus - 105, 108, 112, 113
Equus - 110, 112
Esox - 82, 85, 138
Falco - 43, 60, 71
Ficedula - 56, 74, 95
Fringilla - 58, 74
Fulica - 45, 60, 72
Gallinago - 46, 47, 60, 72, 93, 98
Garrulus - 57, 74
Gavia - 37, 70, 82, 85, 224
Grus - 18, 45, 60, 72, 77
Haliaeetus - 41, 42, 60, 71, 79-86
Heteroscelus - 49, 72
Hirundapus - 51, 73
Hirundo - 52, 73, 93
Histrionicus - 40, 71
Hucho - 137
Hyla - 132
Hynobius - 128
Jynx - 52, 73, 90, 93, 98
Lacerta - 119-121, 123, 124

Lagopus - 44, 72, 85, 223
Lanius - 57, 74, 95, 100
Larus - 34, 49, 50, 59, 60, 72, 82, 85, 224
Lepus - 85, 109
Leuciscus - 138
Limnodromus - 47, 59, 60, 72, 93, 98
Limosa - 47, 72
Locustella - 55, 74, 94, 99
Lota - 85, 138
Loxia - 58, 74
Luscinia - 54, 73, 94, 99
Lymnocryptes - 46, 72
Melanitta - 41, 71, 85
Melanocorypha - 52, 73
Mergus - 41, 59, 60, 71, 82, 85
Micromys - 113
Microtus - 85, 105, 109-114
Milvus - 41, 71
Motacilla - 53, 73, 93, 94, 99
Mus - 109, 112
Muscicapa - 55, 56, 74, 95
Mustela - 108, 112, 113
Myotis - 108, 111-113
Natrix - 119, 122-124
Nemachilus - 138
Neomys - 108, 111, 112
Nucifraga - 57, 74, 96, 100
Numenius - 47, 48, 60, 72, 82, 85
Oenanthe - 54, 59, 73, 74
Ondatra - 82, 85, 105, 109-112
Otis - 45, 72
Pandion - 43, 60, 71
Parasilurus - 137-139
Parus - 56, 59, 74, 95, 224
Passer - 57, 74
Perca - 84, 85, 138
Perisoreus - 57, 74, 85
Phalacrocorax - 34, 38, 60, 70, 224
Philomachus - 46, 72
Phoca - 108
Phoenicurus - 54, 73, 94, 99
Phoxinus - 138, 141-143, 145
Phylloscopus - 55, 74, 90, 99, 100
Pica - 57, 74
Picoides - 52, 73
Plecotus - 108, 112
Pluvialis - 46, 72
Podiceps - 37, 59, 70, 82, 85
Porzana - 44, 72, 93, 98
Pyrrhula - 58, 74
Rana - 127, 129-132
Riparia - 52, 73
Rutilus - 84, 138
Salamandrella - 127-129, 131
Salvelinus - 137
Saxicola - 54, 73, 94, 99
Sciurus - 109, 112
Sitta - 56, 74, 95, 99
Sorex - 107, 108, 110, 112-114
Spermophilus - 113
Sterna - 50, 73, 82, 85, 224
Streptopelia - 51, 73
Strix - 85, 107
Surnia - 51, 73
Sus - 113
Sylvia - 55, 74
Tadorna - 39, 60, 71, 72, 82, 85
Tamias - 109, 110, 112
Tarsiger - 54, 73, 94, 99
Tetrao - 44, 60, 85
Thymallus - 84, 137
Tinca - 137
Tringa - 48, 49, 59, 72, 82, 85, 93, 98
Turdus - 54, 74
Upupa - 52, 73
Ursus - 20, 108, 112, 224
Vanellus - 46, 72
Vipera - 124
Vulpes - 108, 112
Xenus - 49, 72
Zoothera - 54, 74

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